PUBLIC WORKS

Mar.
1952

CITY, COUNTY AND STATE

Colorado's Avalanche Control Program

Unusual Sewerage System Serves Portland

Algal Toxins—What is Known About Them

Chicago's O'Hare Field—Our Largest Airport

Dual Plant Treats Sewage and Industrial Waste

Village Profits from Municipal Power Plant

Rex M. Whitton, Chief Engineer of the Missouri State Highway Commission, is shown here at his desk in Jefferson City. He has a record of 32 years of outstanding service. **More on page 24.**

GALION
TANDEM ROLLERS

ENGINEERED FOR SMOOTH PERFORMANCE

You will find both users and operators completely sold on the results and service received from Galion Tandem Rollers.

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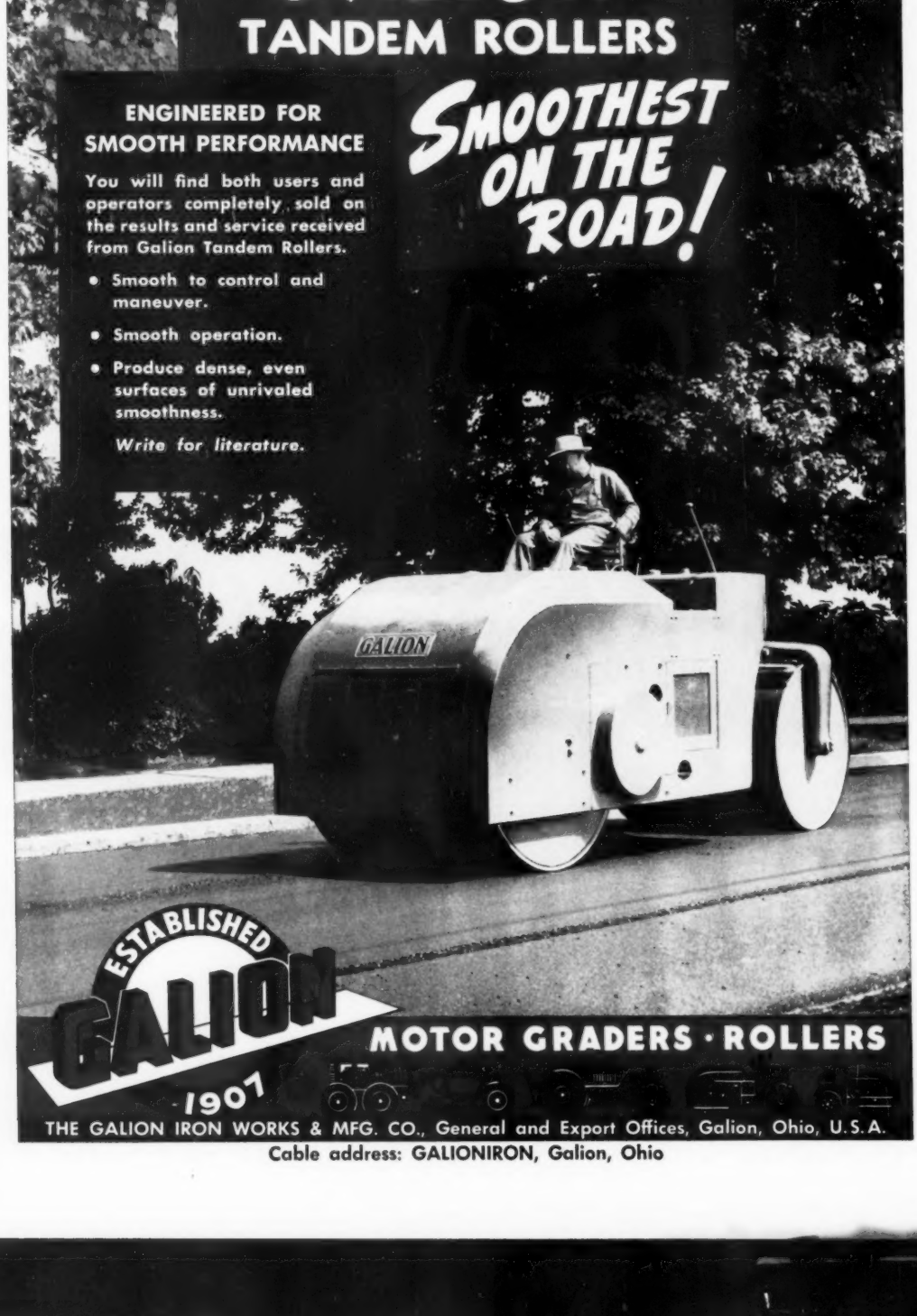

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Santa Barbara, California State Tuberculosis Hospital has a 'Pakage' Plant for complete and economical treatment of its sewage. This is one of over 250 such plants now in successful operation. Design flow is .1 M.G.D. R. W. O'Neill, Engineer.

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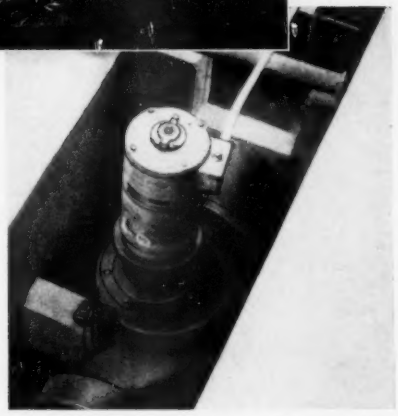
Comminutors • 'Pakage' Plants • Swing Diffusers • Flush-Kleen • Scru-Peller • Horizontal & Vertical Non-Clogs • Water Seal Pumping Units • Samplers • Sludge Collectors • Mechanical Aerators • Precision Diffuser Tubes • Chicago-Selas Heat Transfer Systems • Chicago-Wiggins Pontoon and Lodek Covers • Chicago-Wiggins Gas Holders • Aer-Degritters • Chicago Standardaire Blowers • Stationary Diffusers • Plunger Pumps



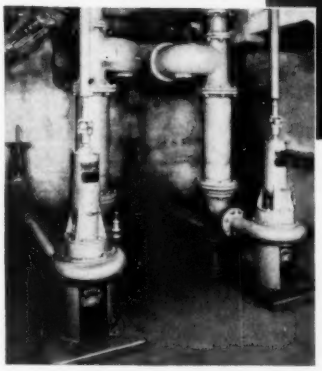
Greenwell Springs, Louisiana State Sanatarium has a comminutor to automatically screen and cut the solids at their 'Pakage' Sewage Treatment Plant. This is one of more than 2500 comminutors installed since 1934. State of Louisiana, Department of Institutions, Engineers.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

622 DIVERSEY PARKWAY
CHICAGO 14, ILLINOIS

Los Angeles, California, has Swing Diffusers and Precision Tubes in the new Hyperion Sewage Treatment Plant. 850 Swing Diffusers and over 19,500 Precision Diffuser Tubes assure continuous and economical operation of the aeration battery. This is one of over 200 sewage treatment plants using Swing Diffusers and Precision Tubes. Board of Public Works, City of Los Angeles, and Metcalf & Eddy, Engineers.

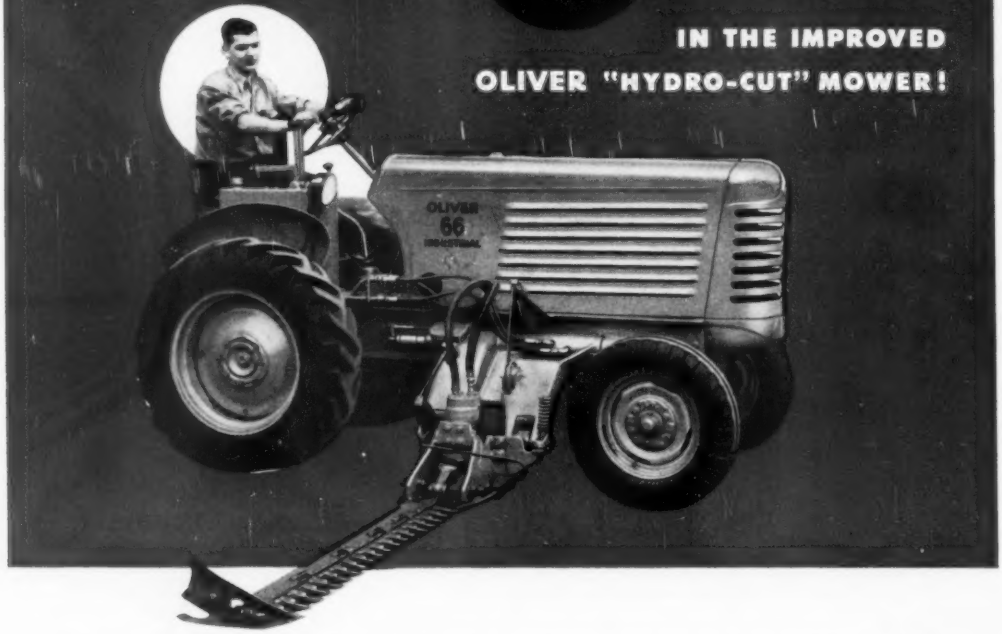


Braintree, Massachusetts, has a Flush-Kleen Sewage Lift Station, the only truly clog-proof pump for handling raw sewage or any liquid containing coarse stringy matter. This is one of over 5000 Flush-Kleen Lift Stations in daily trouble-free operation throughout the world. Samuel M. Ellsworth, Engineer.

Get full details of this month's new products . . . mail your Readers' Service card today.

We Kept the Man in Mind

IN THE IMPROVED
OLIVER "HYDRO-CUT" MOWER!



Operator comfort and convenience . . . simplified maintenance . . . these were the two big things we kept in mind in the improvements we made in the Oliver "Hydro-Cut" Mower.

Actually, our performance reports showed that, from an operating standpoint, our mower was tops in its class. The outstanding Oliver features—hydraulic driven cutter bar that cuts anything from thick matted grass to moderate brush . . . hydraulic drive that assures smooth, practically vibration-free operation . . . hydraulic safety mechanism that virtually eliminates knife damage . . . finger-tip hydraulic control for instant raising or lowering of cutter bar—are retained.

But, now, we've made life easier for the operator. There is no need for frequent oilcan lubrication of the pitman. Pressure lubrication at all required moving points is provided to eliminate need for frequent lubrication. Selective and frequent tightening of the pitman bearings is eliminated.

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A "Hydro-Cut" Mower can be quickly and easily installed in combination with a Loader, Sweeper, or Bulldozer using the same hydraulic pump to operate the combination unit.

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The 1952 volume of Public Works will be available on microfilm through University Microfilms, 313 N. First St., Ann Arbor, Mich.

THE ENGINEERING AUTHORITY
IN THE CITY-COUNTY-STATE FIELD

CLAY PIPE—*ESSENTIAL* ★ *ECONOMICAL* ★ *EVERLASTING*

Rapid City, South Dakota, extends its municipal sewerage facilities in $800,000 program made necessary by defense expansion at Rapid City Air Base.

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Morrisville, Pa. (New Steel Defense Plant)	300,000 ft.	Hartford, N. Y. (Electronic Plant Expansion)	50,000 ft.
Eynon, Pa. (Gun Fire Control Plant)	120,000 ft.	Willow Springs, Ill. (Jet Engine Plant Expansion)	16,000 ft.
Marion, N. C. (Municipal Sewerage)	32,000 ft.	Limestone, Me. (Air Force Base)	65,000 ft.

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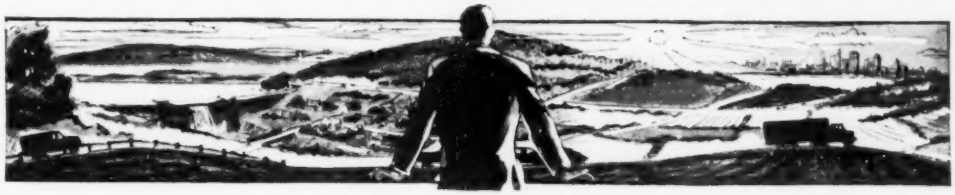
Now's the time to mail this month's Readers' Service card.

THE EDITOR'S POINT OF VIEW



DDT and Those Korean Cooties

A good many of the men who, in World War II, learned to rely on DDT to keep cooties, bedbugs, cockroaches, mosquitoes, flies, mites and other things of the sort out of their hair—so to speak—have no doubt been shocked at the reports of the durability of Korean brand cooties. These beasties were not affected by DDT; instead the application of 10% DDT powder "resulted only in an increase of infestation." Treatment on every third day did not help. Truly, these were tough customers.

Other compounds have been found more effective than DDT and control can no doubt be accomplished. But the lesson is clear—we cannot rely on old materials or old methods. We must re-examine critically what we are doing from time to time; and we must develop better and still better ways of solving our problems. There is no such thing as standing still. We must go forward or we go backward, and this applies to every phase of our work, whether cootie control, waste treatment or highway maintenance.

It is an interesting sidelight that the entomologist who first reported this unusual louse resistance to DDT was soundly berated by his medical officer. Some people truly find new ideas difficult and think change impossible.

Public Relations Help a Lot in Public Works

"Many times information given to a friendly press can help to get approval and understanding of the public for those public works projects that are needed by a community. The aims, the reasons and some of the details, properly presented by the press will always help to make the public more responsive, and oftentimes grateful, for the work done in a community. The aid of the press is almost always assured if administrative officials will cooperate by giving desired information. Withholding such information is usually a big factor in poor newspaper relations."

So writes Orville J. Bumpus, city manager of Sapulpa, Okla., and we agree entirely with him. There has been too little good public relations by engineers, who are so often responsible for public works. They do not always appreciate the necessity for keeping the public informed and sympathetic. Perhaps what we need is to have a course on public relations inserted in our engineering curricula. That wouldn't help the oldtimers so much, but it might make life more pleasant for their successors. We are in favor of it, no matter what it might displace in our college educational program.

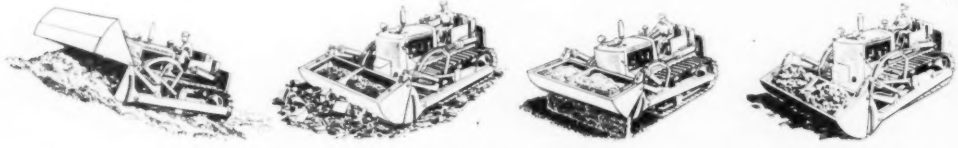
What Has Happened to That R & D Program of the Army?

Another letter from a reserve officer calls attention to the low estate of the Research and Development Group program of the Army. As initially planned, this was an excellent project. It provided — on paper, at least — for useful and interesting work by reserve officers of the staff branches. Properly oriented and given even a dash of leadership, contributions could have been consequential. Communications with reserve officers who are members of such groups indicate that leadership generally has been AWOL and results in keeping.

These groups do not need long-winded discussions by Regular Army lecturers — than whom none can be drier or more deadening — nor do they need reams of listings of research projects. They need someone in each Army headquarters to plan, guide, aid and give leadership. That someone is not available in many or perhaps most cases. Considering that the scientists in these groups get no pay for their work; and that they are even limited in the number of credit hours they can earn, it is to their credit, as officers and professional men, that they have stuck to a profitless task as long as they have.

We hope that we are mistaken to the extent that some of these R & D Groups are able to do a constructive and worth-while job, that they are being given leadership and cooperation, and that a definite plan and program is being carried out by the Army with the firm intent of correcting the faults of the past. Your editor initiated and supervised perhaps the first of such programs back in the mid-thirties. The information it provided was of tremendous value in solving critical problems that arose during World War II. There is no reason why the present program cannot be made to pay off just as well.

DAILY BEAUTY TREATMENT. This 7-acre Michigan City landfill will be 7 to 9 feet deep, including a 2-foot cover of sand. Every night the Bullclam covers the day's compacted refuse with a fresh sand layer, so the material lies in cells which reduce gas formation and guard against later settling.



Prepares the site **Crushes and compacts refuse** **Transports and spreads earth cover** **Grades and levels finished area**

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How Michigan City, Indiana "cleans up" in more ways than one with a Drott Bullclam on an International crawler

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This fast-working equipment scoops out the excavation. It spreads and compacts the refuse—crushing, smashing, grinding it flat beneath the specially-curved Bullclam front. Then it carries the cover dirt and spreads it in place. Finally it grades and smooths the finished fill.

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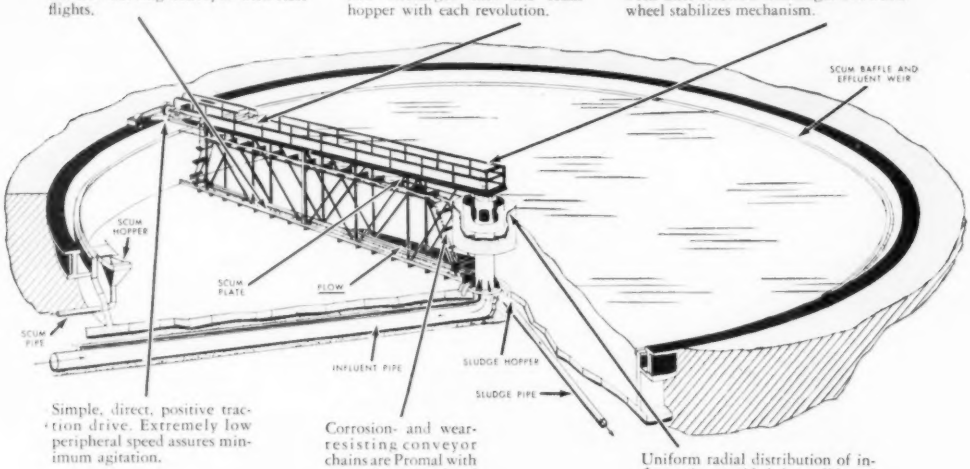
Floating material is carried to a trap at the outer end of the bridge by the return run of the conveyor and discharged into the scum hopper with each revolution.

Rugged bridge pivots on a large ball bearing. Outer end is mounted on a solid rubber tired traction drive wheel equipped with anti-friction bearings. Forward wheel stabilizes mechanism.



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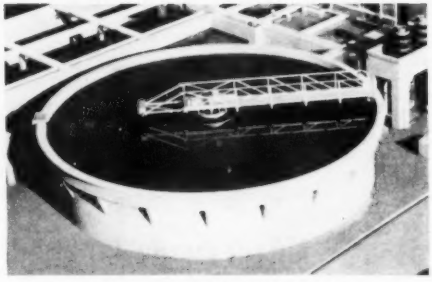

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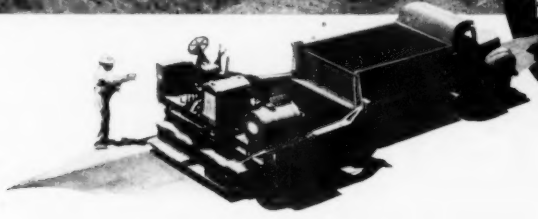

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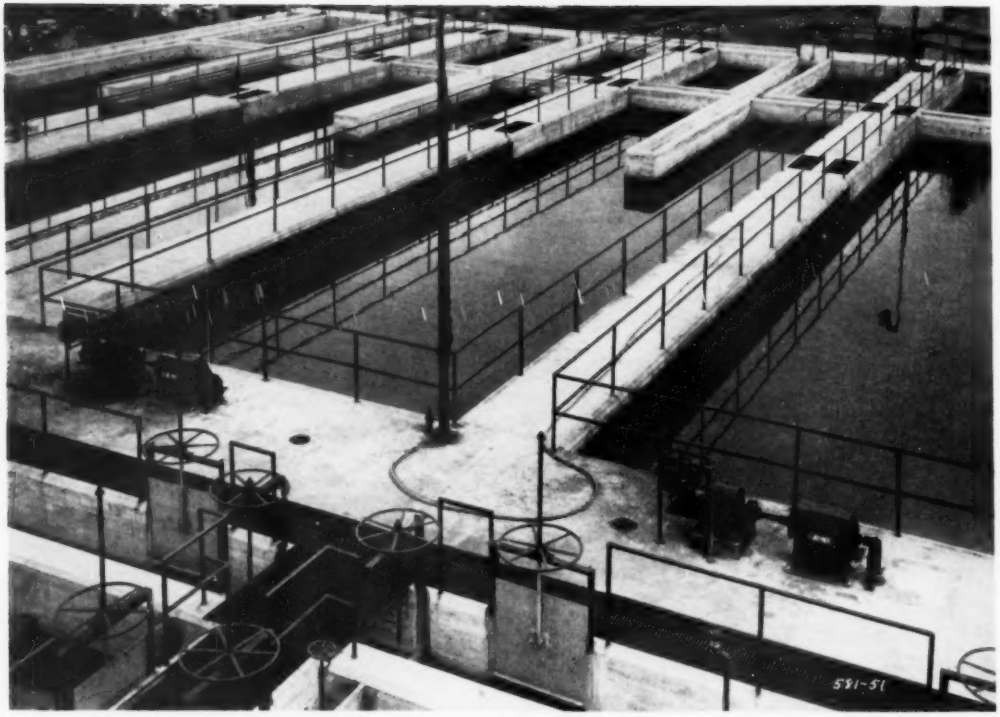

A MODERN WATER WORKS

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City engineers like Jeffrey equipment for both water and sewage treatment . . . they like the way our engineers help them work out the best possible method to get results. You, too, can take advantage of Jeffrey experience and engineered equipment. Write us today.

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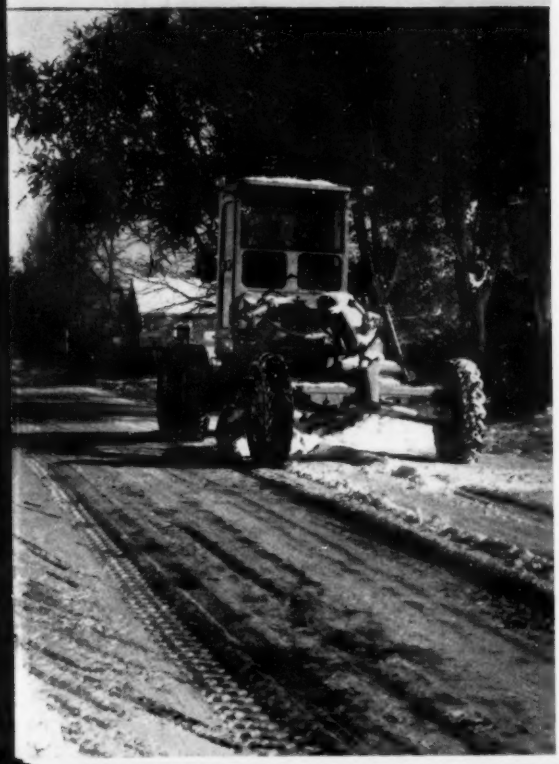

better living

FOLLOWS

better roads

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TRACTORS • MOTOR GRADERS
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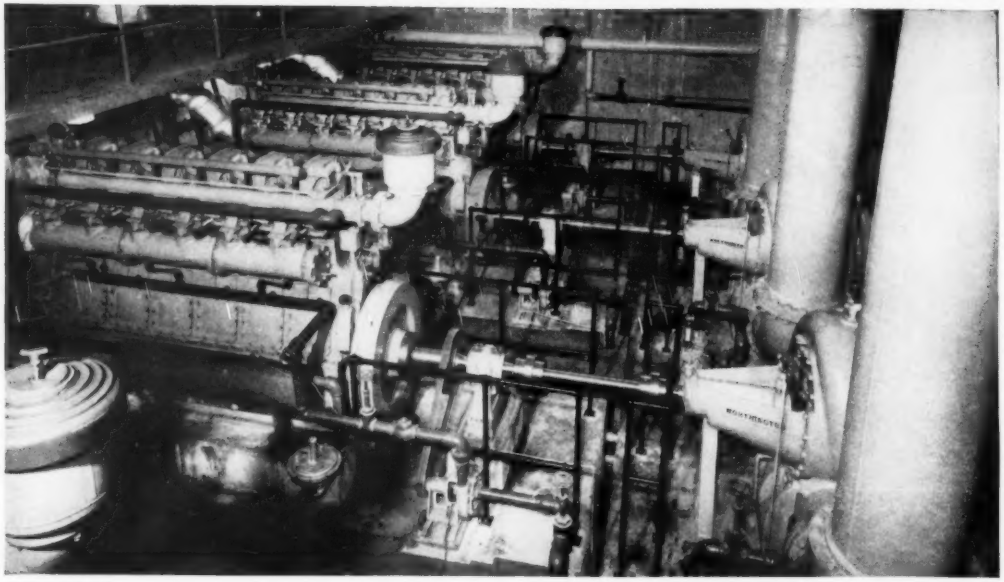

FOUR 20-MGD CENTRIFUGAL PUMPS (right) pump raw sewage into Oklahoma City's Southside Sewage Treatment Plant. Worthington Sewage Gas Engines (left) drive pumps. Installation uses three other such pumps for recirculation, also driven by Worthington engines.

An exact match for Oklahoma City's needs

The right *equipment for new sewage plant selected from Worthington's complete line*

An outstanding job in every way. That's what they're all saying about the new Southside Sewage Treatment Plant at Oklahoma City.

Seven giant Worthington 20-mgd centrifugal pumps used for pumping raw sewage and recirculation are driven by Worthington gas-engines that are fueled by methane gas from raw sewage.

Oklahoma City's modern plant—like virtually every municipal installation—had *special* requirements. They met these requirements with Worthington equipment—engines, pumps, and other apparatus such as air compressors.

To municipalities like Oklahoma City, Worthington means getting *all* major public works equipment under *one* responsibility. Engines for any available fuel, the world's most complete line of pumps, comminutors, air compressors, water treating equipment, motors, and power-transmission equipment.

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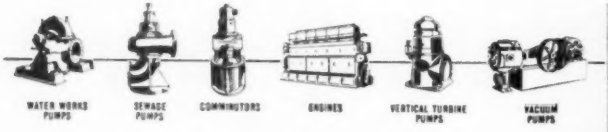

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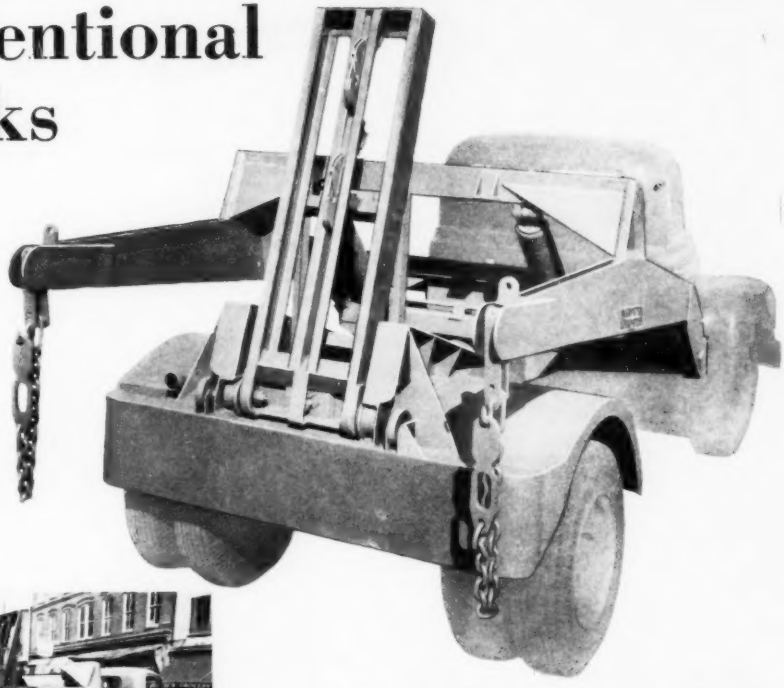
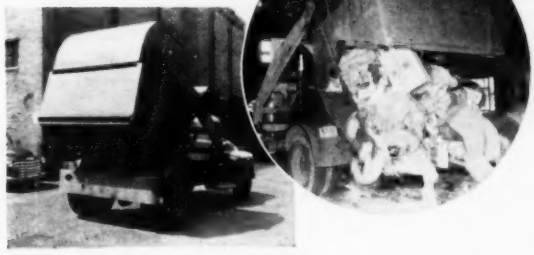
The DEMPSTER DUMPSTER® Rubbish Collection System

Eliminates 3 to 5 Conventional Trucks



THREE STAGES of quick pick-up, hauling and dumping are shown while Dempster-Dumpster is at work in Norfolk, Va.



One truck-mounted Dempster-Dumpster picks up, hauls and empties, one after another, a multiple number of detachable containers . . . eliminating 3 to 5 conventional trucks and crews. Containers are spotted at hospitals, schools, business establishments, etc. and loaded by the user. Container sizes range up to more than three times the capacity of the average dump truck body. For low cost, efficient and sanitary bulk rubbish collection, your city needs the Dempster-Dumpster System. Manufactured exclusively by Dempster Brothers, Inc.

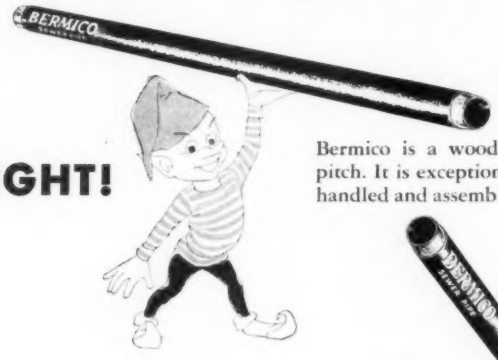
One Dempster-Dumpster Services All Containers . . . All Designs. . . All Sizes

DEMPSTER BROTHERS 932 Dempster Bldg. Knoxville 17, Tenn.

Need more facts about advertised products? Mail your Readers' Service card now.

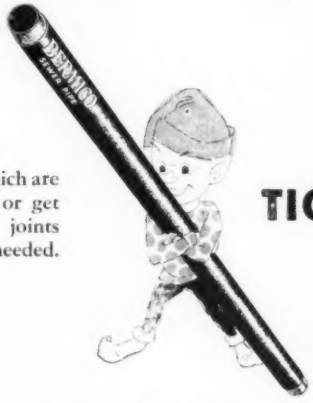
BERMICO®

SEWER PIPE



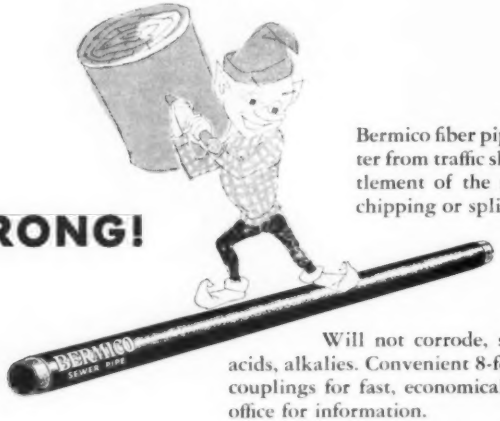
LIGHT!

Bermico is a wood fiber pipe, impregnated with pitch. It is exceptionally light in weight, and easily handled and assembled.



TIGHT!

Bermico fiber pipe has tapered sleeve joints which are root-proof, water-tight, will not pull apart or get out of alignment. A few hammer taps seal joints permanently, and no joining compound is needed.



STRONG!

Bermico fiber pipe is sufficiently flexible so it will not shatter from traffic shock nor rupture as a result of uneven settlement of the subbase. Absorbs jars and jolts without chipping or splitting.

Will not corrode, scale or tuberculate. Unaffected by sewage, acids, alkalies. Convenient 8-foot lengths and a complete line of bends and couplings for fast, economical assembly. Write Dept. EB-3 at our Boston office for information.

BROWN Company

Berlin, NEW HAMPSHIRE

GENERAL SALES OFFICES: 150 CAUSEWAY STREET, BOSTON 14, MASS.

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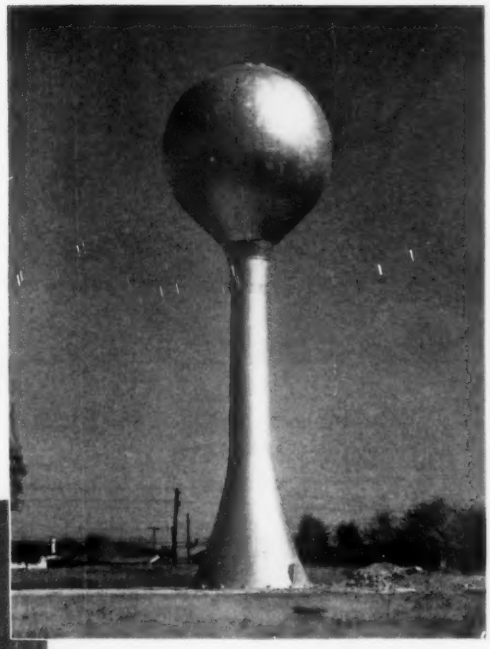
Now's the time to mail this month's Readers' Service card.

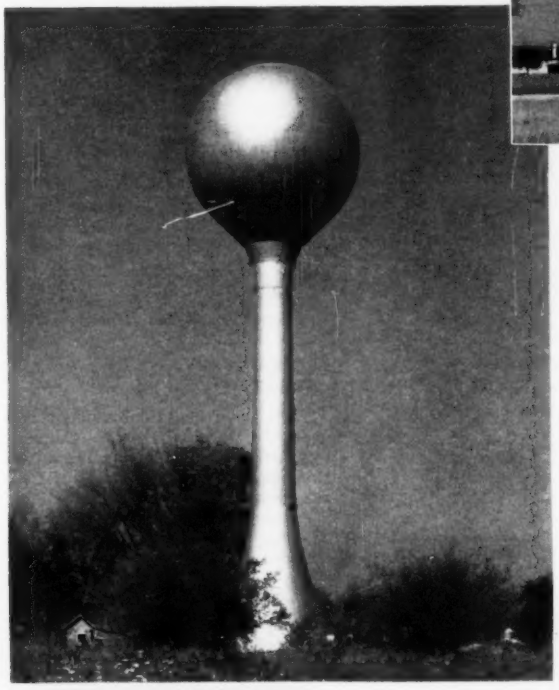
WATERSPHERES

...a Modern Approach

to More Efficient

MUNICIPAL WATER SERVICE





Growing cities often find it difficult to provide satisfactory water service throughout their entire distribution systems. This is particularly true when (1) there are areas of heavy demand some distance apart or (2) when the transmission mains are inadequate to supply peak demands.

Hobart, Indiana, however, has made sure that 2,110 customers *throughout the city* will always get enough water when they need it. Twin 150,000-gallon Horton Waterspheres have been installed at widely separated locations to provide maximum efficiency in water service. In addition to furnishing dependable gravity pressure, they also assure an uninterrupted water supply in case of power failure, and a reserve immediately available for fire protection.

Many similar communities have found gravity-backed storage in Waterspheres the logical answer to better water service. They are built in standard capacities from 25,000 to 250,000 gallons. Write our nearest office for quotations or information if you are planning new storage facilities. There is no obligation on your part.

HORTON

WELDED STEEL

STORAGE TANKS

CHICAGO BRIDGE & IRON COMPANY

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

Atlanta 3 ..... 2123 Healey Bldg.	Los Angeles 17 .. 1508 General Petroleum Bldg.
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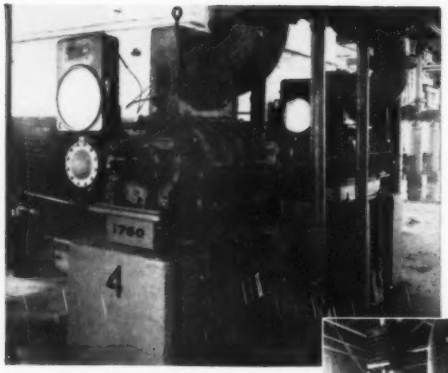
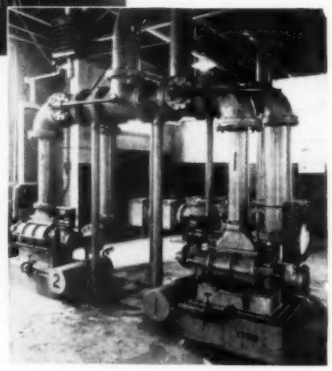
Chicago 4 ..... 2115 McCormick Bldg.	Philadelphia 3 ... 1648-1700 Walnut St. Bldg.
Boston 10 ..... 1038-201 Devonshire St.	San Francisco 4 ..... 1525-200 Bush St.
Cleveland 14 ..... 2221 Guildhall Bldg.	Seattle 1 ..... 1339 Henry Bldg.
Detroit 26 ..... 1536 Lafayette Bldg.	Tulsa 3 ..... 1641 Hunt Bldg.
Houston 2 ..... 2142 C & I Life Bldg.	Washington 6, D. C. ..... 1120 Cafritz Bldg.

Thousands use our Readers' Service card to keep up to date . . . do you?



Part of an installation o nine R-C Meters in a larg plant, some of which date back 10 years or more Capacities range from 3,000 cfh to 130,000 cfh



YOU CAN ALWAYS

trust

R-C METERS

Continued repeat orders for R-C Positive Displacement Meters indicate the complete confidence of sewage treatment plant operators in the unvarying reliability of these units. Many have been installed so long that the original dates have been forgotten—yet they continue to measure as dependably as the day they were first put into service. That is because:

1. **Accuracy is not affected by variations in specific gravity, rate of flow, pulsation, moisture, impurities or uncontrollable factors.**

2. **Accuracy is not subject to adjustment of meter or recorder by operators or other persons.**

3. **Accuracy is not affected by reasonable overloads.**

4. **Accuracy is permanent because measuring chambers are surrounded by precision-machined, cast iron surfaces.**

Compactness of R-C Meters permits installation in cramped spaces. Sizes from 4,000 cfh to 1,000,000 cfh provide range for all sewage treatment applications. Indicating and recording devices are available. Ask for details in Bulletin 40-B-14 or write us about your needs.

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ROOTS-CONNERSVILLE

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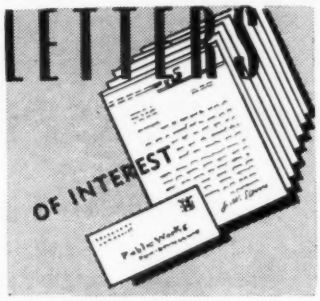

CONCRETE PAVING OF 1911

Recently I was discussing with a representative of the Portland Cement Association the original concrete pavement laid in Sioux City back in 1911. If I remember rightly, I wrote an article about this pavement and especially about an open-faced tamper which I designed in order to make possible the laying of one-course concrete pavement. I would appreciate having you check your index and let me know if my memory is correct; and if it is, I would like to get a photostat of the article.

Keyes C. Gaynor,
City Engineer
Sioux City, Iowa

Mr. Gaynor's memory is correct. The article appeared in Public Works in 1912 and we are happy to send him a photostat of it.—Editor.

SLUDGE TREATMENT

I am interested in obtaining complete data on chemical treatment of sludge for small communities, as published in Public Works for December. I am designing a plant for a suburban subdivision for low-cost housing. Any assistance you can render will be appreciated.

Earl J. Wentworth,
Consulting Engineer,
San Antonio, Texas

Messrs. Leibee and Smith, the authors of the article, have kindly sent the information requested by Mr. Wentworth.—Editor.

NOTES FROM "DOWN UNDER"

Thank you for the file copies you have loaned me. I have received considerable help from your organization and must thank you for all the work you have done in our behalf, especially in view of the fact that the information we receive can

→ For Your Water Fluoridation Program

GENERAL CHEMICAL

SODIUM SILICOFLUORIDE

SODIUM FLUORIDE

Readily Available From Coast-to-Coast Distribution Points

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Here's How General Chemical Technical Service Can Help You in Planning Your Program:

- **By recommending which fluoride compound is most suitable for use in your water system.**
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- **By helping to determine where fluoride compounds can be added most effectively to the water system.**
- **By offering technical advice on methods of controlling fluoride concentration.**
- **By recommending safe handling procedures of fluoride compounds to water works personnel.**

For more than half a century General Chemical Technical Service has helped municipal officials and water works operators with their chemical problems. This same service is available—without cost or obligation—for your fluoridation program. For further information on General Chemical fluorides . . . and technical service . . . consult the nearest company office listed below.

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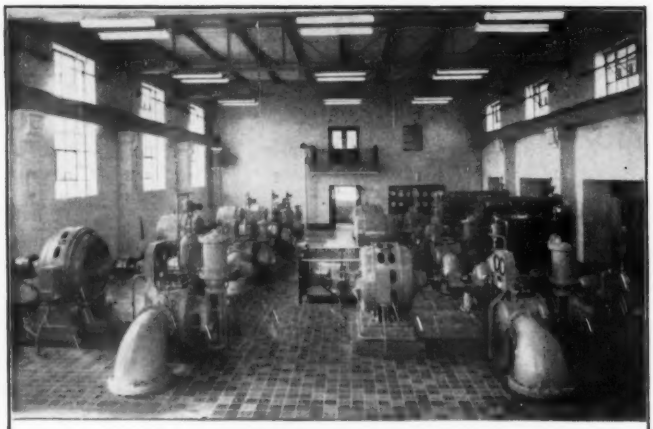

High Service Pump Room, Evanston, Illinois Water Works

climax BLUE STREAK ENGINES

Staying Power FOR STANDBY SERVICE

Climax Blue Streak Engines drive generators and pumps in standby service, or furnish continuous power where natural or by-product gas is available in municipal water works plants.

For water works service Climax Blue Streak Engines are the choice because of their low upkeep expense, extra quick starting and sufficient surplus capacity to supply power for an indefinite period of time.

Two Climax 12 cylinder, 6¼ x 7, 425 H.P. Gasoline Engines Direct Connected to 10 MGD Pumps for Standby Service in Evanston Water Works.

Write for complete information and specifications on these dependable power plants. There are 4, 6, 8 and 12 cylinder engines, rated from 40 to 600 H.P., operating on natural gas, Butane or gasoline. Sewage gas engines are available in sizes 50 to 250 H.P.

climax ENGINE AND PUMP MFG. CO.

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be of little financial benefit to firms who supply it. The world financial situation makes it almost impossible for New Zealand to buy from America. I send you all best wishes for 1952.

W. I. Gardiner,
Borough Engineer,
Onehunga, Auckland,
New Zealand

BOOKS IN BRIEF

EMERGENCY PREPAREDNESS

The Division of Civil Defense of the State of New Jersey has published an excellent manual on "Emergency Medical and Health Preparedness." This is contained in the July issue of Public Health News, published by the N. J. State Department of Health. The 56 pages of data are unusually complete and sound. For a copy, write to Division of Civil Defense, State Department of Defense, State House Annex, Trenton 7, N. J.

BETTER SPEECH

This book will tell you something about how to make better talks and speeches, covering the four fundamentals—speaker, speech audience and occasion. In the second part are discussed the common types of business and professional speeches. By Lionel Crocker, Denison University; 470 pages. The Ronald Press Co., New York. $4.

80TH YEAR

The Rock Island, Ill., Municipal Water Works has issued its 80th Anniversary booklet, a history of the city and of the water works system. It is a booklet and a history of which the city should be proud. It was sent to us by Nicholas J. Hoeltzner, Water Works Superintendent, who has served the city for 45 years. We offer our sincere congratulations.

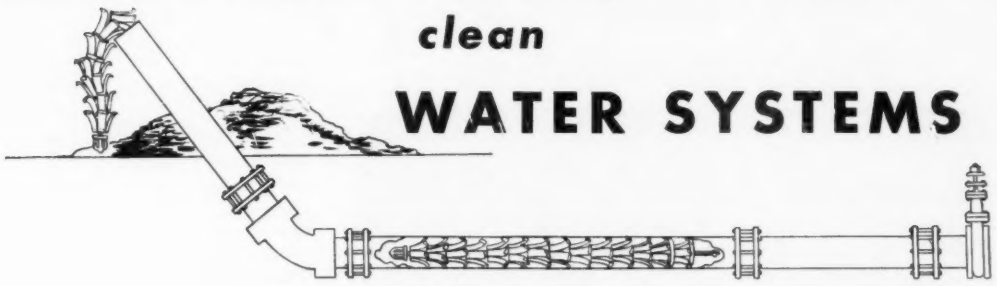
TAXICAB REGULATION

The cab-regulation practices of 23 of the 25 American cities above 400,000 population are presented in this report "Municipal Regulation of Taxicabs." The survey and report were presented by J. R. Kerstetter of the American Municipal Association, 1313 East 60th St., Chicago 37, Ill. Copies are 50¢.

ACE Pipe Cleaning Contractors

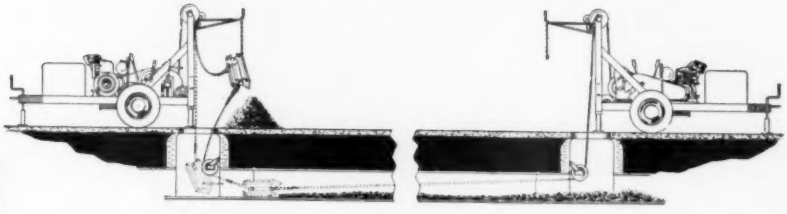
clean

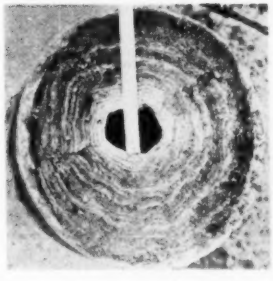
WATER SYSTEMS



and SEWER SYSTEMS

Anywhere
Any Time
Any Size
24 Hours a Day
7 Days a Week





Neglected city and industrial water pipes fill with debris like this—cut down service, increase fire rates. Let ACE clean them for you!

Fast, modern water pipe and sewer cleaning service—that's what ACE Pipe Cleaning Contractors, Inc., offers your city or industry *today,* wherever you are in the United States or Canada!

Preserve your system "for the duration," while pipe and steel are in short supply, with this thorough, economical service.

ACE brings the most modern equipment known to the job, plus trained, skilled crews to get the job done right, quickly and at *lowest possible* cost. ACE has representatives in several principal cities, ready to serve you. Write for further information. Let us send a man, at no expense or obligation to you. Get in touch with us today!

Cleaning jobs done thus far in 1951: Corps of Engineers, U. S. Army; City of Kansas City, Missouri; City of Kansas City, Kansas; Swift & Company; Armour & Company; Cudahy Packing Company; General Motors Corporation; Olathe, Kansas; Belton, Missouri; Milburn Country Club; Council Grove, Kansas; Procter & Gamble Mfg. Company.

✻ Ask to see our new 21-minute newsreel movie of the great Kansas City Flood of July, 1951. No cost or obligation.

ACE Pipe Cleaning Contractors, Inc.
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2003 Indiana Kansas City 1, Mo.

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Why Most Pipe Fitters Buy RIDGID Pipe Wrenches

Guaranteed RIDGID wrench housing saves you repair trouble and expense

- ★ It's an extra fast easy wrench to work with, too—handy pipe scale on hookjaw, adjusting nut spins easily to pipe size, comfort-grip handle.
- ★ Special alloy jaws both replaceable—won't slip or lock on pipe.
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- ★ Save money, make work easier—buy RIDGID, world's most popular pipe wrench, at your Supply House.

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★ ★ ★ RIDGID Work-Saver Pipe Tools ★ ★ ★

Thousands use our Readers' Service card to keep up to date . . . do you?

REPORT TO THE PEOPLE

Cleveland, O., in its 1951-52 "Annual Report to the People", has done a remarkably fine job of public relations. In language easily understandable, this report tells what has been done and what are the major problems facing the city. Excellent illustrations. 48 pages. Also, "Our Downtown Parking Headache", a publication of the Cleveland City Planning Commission. This report analyzes the problem of downtown parking and suggests a solution.

STREETS & HIGHWAYS

The proceedings of the Third California Conference on Street and Highway Problems have been bound and are for sale. These include 34 papers on the various phases of the subject. Paper bound; 132 pp., 8½ by 11, some illustrations. University Press, University of California, Berkeley 4, Calif. $1.

WASTE DISPOSAL

The proceedings of the Sixth Purdue Industrial Waste Conference have been published as Engineering Extension Bulletin No. 76. This contains many papers of interest and value. Order from Dean A. A. Potter, Executive Bldg., Purdue University, Lafayette, Ind. 506 pages: $1.25.

SCHUYLKILL DESILTING

The final report of the Schuylkill River Project Engineers on the clean-up of that river has been published. The report is replete with maps, photographs and charts and shows what has been done in the program of restoration. Those interested in similar work will find this report of much value. The address of the Engineers is 20 South 15th St., Philadelphia 2. Since this is a large and costly report, there is question of its wide availability.

BITUMINOUS STANDARDS

This is a compilation of 98 ASTM standard and tentative specifications, test methods, recommended practices and definitions of terms pertaining to bituminous materials for highway construction, waterproofing and roofing. 344 pages. $3.25 from ASTM, 1916 Race St., Philadelphia 3, Pa.

Duluth "does everything" with PAYLOADERS

Three years of "PAYLOADER" use finds Duluth taxpayers and city officials united in their praise of "PAYLOADER" tractor-shovels. The city's fleet of four machines is kept busy all year 'round on street, park, water, gas and sewage programs. Duluth officials have proved that "PAYLOADERS" can do much to provide adequate city services in spite of limited budgets and staffs. In this they echo the experience of cities, counties, townships and states from coast to coast. You are invited to write for full data. The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Illinois.

Park Department

The maintenance of thirty-five miles of roadways, plus ball parks, playgrounds, a zoo and golf courses keeps its Model HF "PAYLOADER" busy spring, summer, winter and fall. It loads dirt, gravel, oil-mix, stumps, timber, compost and leaves. The Superintendent says, "We have done many things we never had time to do before. This year we raised the level of the entire ball park and levelled all infields with our 'PAYLOADER' ".

Water—Sewer—Gas Department

uses its Model HF "PAYLOADER" to grade ahead of trench-digging . . . to load dirt and materials, to load sand for backfill, to backfill trenches, unload and load pipe at storage, unload pipe at the job and to carry and lower it into place. Because the "PAYLOADER" operates easily in heavily congested areas and moves quickly from job to job the department accomplishes more work with its limited budget.

Public Works Department

Two 4-wheel-drive 1½ yd. Model HM "PAYLOADERS" are mainstays for street and alley work. They load sand, dirt, refuse, leaves and snow. V-plow attachments make them very effective snow fighters whose powerful hydraulic lift enables them to bust any drift. The Superintendent says, "The use of our "PAYLOADERS" is limited only by the jobs we have to do. They'll double for us on almost any job, wherever it is".

SAY "HUFF"
PAYLOADER®
THE FRANK G. HOUGH CO. • Since 1920

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Suppliers to GOVERNMENT and INDUSTRY for 75 Years... to the ARMED FORCES through three wars!

Bendix Friez is part of a great industrial organization whose peace-time potential is being maintained while engaged in vital work for national defense. We are doing our utmost to deliver non-military items such as meteorological instruments, electronic devices, thermistors and a variety of other equipment consistent with our other high priority business.

We invite your inquiries... *write Dept. M.*

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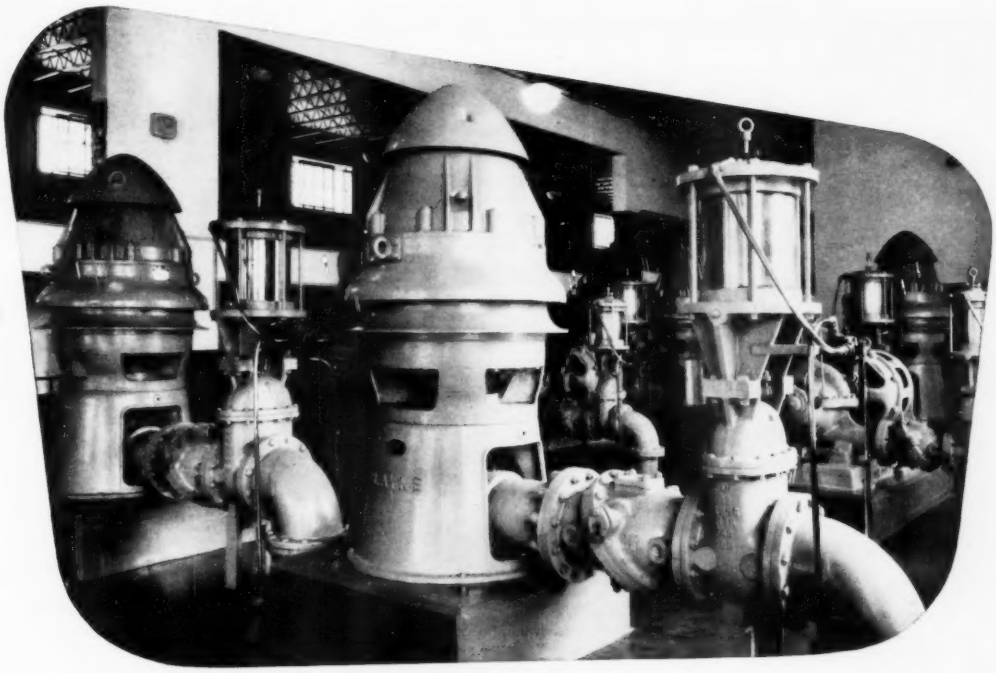
LEADERS IN THE PUBLIC WORKS FIELD

★

Rex M. Whitton has been with the Missouri State Highway Commission since 1920. He was graduated from the University of Missouri with the degree of BS in CE on April 22 of that year and started with the State Highway Commission on May 1. He has come up through the ranks of the Commission and was State Maintenance Engineer for 15 years preceding his appointment as Chief Engineer, in which position he is Administrative head of the Highway Department.

He is Chairman of the Maintenance Department of the Highway Research Board, a member of the Missouri Society of Professional Engineers, of the ARBA, the AASHO and of Rotary. He is President of the Lake of the Ozarks Council, Boy Scouts of America, and a Deacon of the First Baptist Church. He is married and he and Mrs. Whitton have one son, now a junior in civil engineering at the University of Missouri.

His first job with the State Highway Commission was on field survey; after a few months of this, he was brought into the main office. Thereafter, he served in the Kansas City Division, at Sikeston, and at Springfield, with a tour at Jefferson City in the meantime. In 1936, he became Engineer of Maintenance, which position he held until his promotion last year to the post of Chief Engineer, for which place his broad experience, fine personality and marked ability qualify him unusually well.



LAYNE PUMPS

Catalogs

—on Layne Short Coupled vertical turbine service pumps are illustrated with many installation pictures and diagrams of their use in line boosting, spray ponds, river intakes, cooling towers, engine cooling, etc. A copy will be sent on request. No obligation.

serving the city of decatur, alabama

Nine Layne river intake and filtered water pumps have been installed to quadruple Decatur, Alabama's city water supply. Four of these short coupled vertical turbine pumps have a combined capacity of 4-million gallons of filtered water daily.

These self priming, space saving pumps are Layne designed and precision built to maintain peak operating efficiency. They are constructed of materials selected for durability and are rugged enough to give excellent service for the years to come.

Like the city of Decatur, a great number of other municipalities, factories, processing plants and chemical works have found Layne pumps to be exactly as described. All are engineered for the job they are to do . . . and all more than fulfill their performance obligations. For further information address

LAYNE & BOWLER, INC.
General Offices, Memphis 8, Tenn.

Layne

water wells

VERTICAL TURBINE PUMPS-WATER TREATMENT

Need more facts about advertised products? Mail your Readers' Servi e card now.

Free EQUIPMENT DATA TO HELP YOUR PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in Engineering and Public Works programs. Just circle numbers you want on the coupon or write the manufacturer direct and mention PUBLIC WORKS.

NEW LISTINGS

Three-Wheel Roller For General Purpose Duty

142. A new 20-page bulletin describing general purpose 3-wheel rollers covers 8, 10, 12 and 14-ton gasoline and diesel models of the Huber line. Illustrations and comprehensive explanation show component parts of the rollers and describe the general duties of the units. For your copy of this attractive bulletin, No. H-150, write the Huber Mfg. Co., Marion, Ohio, or use the coupon.

Chemical Feed Pump For Chlorinating and Fluoridation

167. For complete data on a heavy duty, positive displacement, diaphragm type pump for accurate feeding, chlorinating and fluoridation solutions, get new Bulletin PM 20 issued by Precision Machine Co., 5 Union Sq., Somerville 43, Mass. Use the coupon today.

Design Data for Insulated Piping

188. For all jobs where insulated piping is required you will want full design data on Ric-wil Prefabricated Insulated Piping. Get 28-page catalog from the Ric-wil Co., Cleveland, Ohio, for details on both underground and overhead lines.

Salt Stockpiling Allows Economical Buying

133. With inexpensive "Rayn-Shed" covers you can buy rock salt in economical quantities and stockpile it for winter use. Check coupon now to get data sheet for estimating sizes of Rayn-Shed covers for your storage requirements. Cayuga Rock Salt Co., Inc., Myers, N. Y.

Helpful Data on Distributors For Bituminous Materials

240. Two models of pressure distributors featuring uniform pressure and temperature-accurate displacement pumping and fast loading are covered in Bulletins RS 31549 and RS 12046, available from Standard Steel Works, Dept. PW, North Kansas City, Mo. Check the coupon to request your copies.

Pipe Detector Determines Exact Location and Depth

120. Determination of the exact location and depth of buried pipes, valves, service cables and other metallic objects can save costly digging and unnecessary damage. Your work can be speeded when you use the Detectron pipe detector, which features simple operation, shielding to avoid static interference, economical unit construction and a lifetime guarantee. Get full data from Detectron Co., 5631 Cahuenga Blvd., No. Hollywood, Calif., by using the coupon.

Be Sure To Investigate The Be-Ge Trencher

171. Municipalities and contractors both report that the Be-Ge trencher, with its fully hydraulic operation and easy maneuverability, cuts costs and brings profits on all types of trenching jobs "Hydratans" fluid motor delivers smooth, positive power at any creep speed. Digs up to 24" wide and 5 ft. deep. Hydraulically controlled backfiller blade is standard equipment. Get form 520 from Be-Ge Mfg. Co., Gilroy, Calif., by checking the handy coupon.

Chemical Control of Pests and Odors

190. Uses of Chloriben include control of insects and keeping sewage fresh in sewer systems, scum control in digesters, odor and insect control on landfills and waste lagoons. Get full details by checking the coupon. Chloriben Corp., 225 Mercer St., Jersey City 2, N. J.

Data on Automatic Primers For Centrifugal Pumps

119. Suction lift, unsubmerged centrifugal pumps are kept always primed and ready to pick up the load by use of the Apco automatic primer or the V-Apco automatic vacuum primer. With the latter, multiple pump installations may be served by a single primer unit. For full engineering data showing operation, typical installations and proper sizes for your needs get Bulletin 547-B and 2047-D from Valve & Primer Corp., 356 West Huron St., Chicago 10, Ill. Check the coupon.

Not Sure You Need A Hydrocrane? Just See What One Can Do!

185. In one of the most appealing bulletins we have seen there are over 100 illustrations showing the versatile, all-hydraulic Hydrocrane performing dozens of different jobs. You could keep one busy with digging, trenching, backfilling, cleaning catch basins, loading and unloading, hoisting and erecting, materials handling, placing pipe, and on many other applications. For the full story of this mobile, truck-mounted machine just check the coupon today. Bucyrus-Erie Co., South Milwaukee, Wis.

Valuable Booklet Tells Soil Stabilization Facts

206. All forms of soil stabilization, using any type of binder with any suitable aggregate, are covered in "Soil Stabilization Methods," Bulletin 25 published by Seaman Motors, Inc., Milwaukee 3, Wis. Get this valuable booklet for complete information on processing methods and the many uses of the Seaman Pulvi-Mixer by checking the coupon.

Technical Service Offers Help on Fluoridation Planning

207. Helpful information to assist in planning new installations and improvement of existing fluoridation systems is available from General Chemical Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y. Check the handy coupon today.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co, Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the coupon.

MORE LISTINGS ON PAGES 28 TO 34

Clip AND MAIL TODAY

READERS' SERVICE DEPT. PUBLIC WORKS MAGAZINE 310 East 45th Street, New York 17, N. Y.

Please send me the following literature listed in the Reader's Service Dept. of your March issue.

Booklets from pages 26-34:

20	21	23	25	30	32	33	40	44	46	47	50	51	55	61	65	66	69	72
75	76	77	80	84	90	95	97	99	102	106	107	109	118	119	120	122	124	127
133	135	141	142	145	146	148	149	150	152	158	160	163	164	167	171	172	173	175
176	177	182	184	185	186	188	190	191	192	195	202	203	204	205	206	207	211	212
213	214	224	234	238	240	249	256	264	272	274	278	279	280					

New Products, pages 91-95:

3-1	3-2	3-3	3-4	3-5
3-6	3-7	3-8	3-9	3-10
3-11	3-12	3-13	3-14	3-15
3-16	3-17	3-18	3-19	

Name .....

Occupation .....

Street .....

City ..... State .....

THIS COUPON NOT GOOD AFTER APRIL 30th, 1952

Fast Marker for Traffic Guide Lines

205. Free-floating, adjustable paint shields on the Mark-Rite Econo-Liner follow surface contours and produce sharp lines in any width from 2" to 6". The machine is said to paint 10,000 to 15,000 feet of line per hour. For details write Universal Mfg. & Sales Co., 8716 Santa Fe Ave., South Gate, Calif., or use the coupon.

Catalog Covers Complete Line of Adams Road Machinery

172. All machinery in the Adams line of road building and maintenance equipment are illustrated and described in an attractive new catalog, Form 5110, issued by the J. D. Adams Mfg. Co., Indianapolis, Ind. Included are motor graders, self-propelled Traveloader, pull-type graders and accessories, shown at work on all types of jobs. Check coupon for your copy of this comprehensive booklet.

Non-Clogging Vertical Wet-Pit Pump Described

182. Full engineering data on Worthington "Freeflo" wet-pit pumps with non-clogging impellers capable of passing solids and stringy material are included in Bulletin W-317-B12. Check these pumps for sump, sewage and drainage service. Bulletin available from Worthington Pump & Machy. Corp., Harrison, N. J. Just use the coupon.

The Coupon Will Bring You Data on Over 100 Products!

Three Steps To Tighter Sewer Joints

184. For sewer joints that stay tight and prevent infiltration of ground water, be sure to investigate the three-step Presstite system. Illustrated folder show application of primer, Ropax packing and Kalktite internal setting asphaltic sewer joint cement to produce economical, permanent joints. For your copy write Presstite Engineering Co., St. Louis 10, Mo., or check coupon.

Stop Water Seepage Through Absorbent Materials

196. For a solution to water seepage problems through all types of absorbent material such as concrete blocks, cement mortar and paint, brick and plaster, be sure to investigate Haynes Formula 640, a clear, penetrating liquid that has great penetrating power. Descriptive bulletins from Haynes Products Co., Omaha 3, Nebr.

Beautiful Lawns Enhance City Property

212. For every step in lawn care and seasonal maintenance be sure to read "Lawn Care", an interesting periodical sent without obligation by O. M. Scott & Sons Co., 80 Spring St., Marysville, Ohio. Just check the coupon.

Drill Any Size Hole In Any Masonry Material

124. A helpful bulletin to aid in the selection of carbide-tipped rotary drill bits is available from the New England Carbide Tool Co., 60 Brookline St., Cambridge 39, Mass. Charts show the proper type bit and drill for all masonry materials and hole sizes. For your copy, check the coupon.

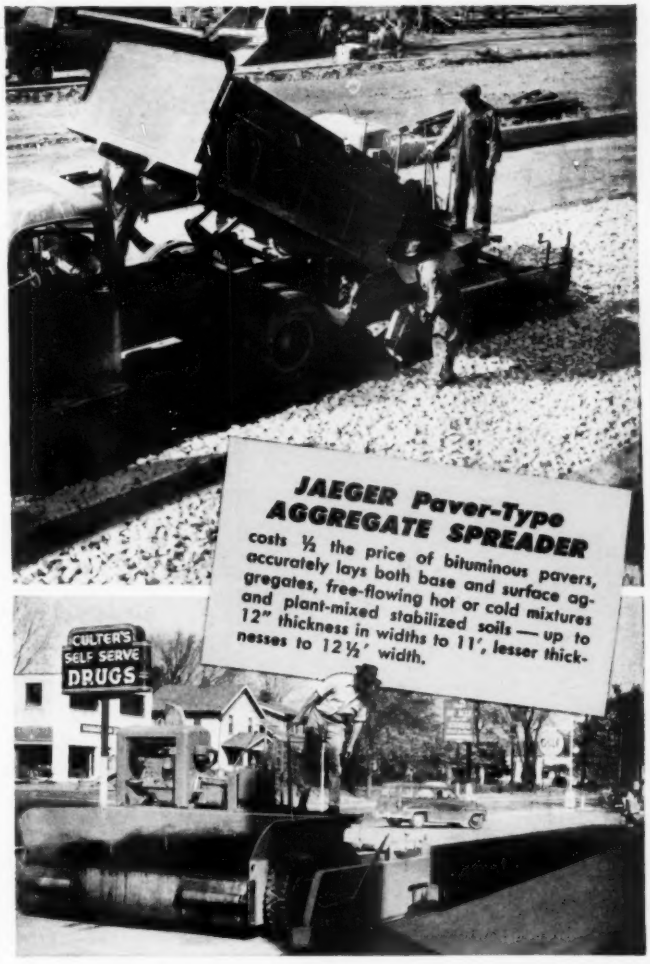
All-Purpose Spreader for Seal Coating and Ice Control

203. Fast, accurate and economical spreading for seal coating and ice control are features of the Model B Hydro-Spreader manufactured by Central Engineering Co., 4429 W. State St., Milwaukee 8, Wis. Spreader has hydraulic drive from power take-off and does not interfere with normal operation of dump truck. Check the coupon for full data.

Volumetric and Gravimetric Feeds for Fluorides

204. Two bulletins issued by Omega Machine Co., 356 Harris Ave., Providence 1, R. I., describe features of gravimetric and volumetric models of the Omega Fluoridizer. Operating details, capacities, installation data and a discussion of fluoride compounds are included. Get Bulletins 50-H14 and 30-H21 by checking the coupon.

Highway base, secondary road or black top drives—Lay them at less cost


JAEGER Paver-Type AGGREGATE SPREADER
costs ½ the price of bituminous pavers, accurately lays both base and surface aggregates, free-flowing hot or cold mixtures and plant-mixed stabilized soils — up to 12" thickness in widths to 11', lesser thicknesses to 12½' width.
CULTER'S SELF SERVE DRUGS

Designed to meet the need of both large and small contractors and highway departments, this low cost spreader lays many types of materials, in a wider range of widths and thicknesses, with the accuracy required for highway, street and airport base and both the base and top of secondary roads, parking lots and drives. Crawler or 4-wheel traction is on subgrade to avoid displacing loose material. Straightedge runners control level of strike-off. Blends joints; can lay flush to curbs, headers. Two models, to work with all size trucks.

For details, see your Jaeger distributor or send for Catalog SPS-1.

THE JAEGER MACHINE COMPANY

400 Dublin Avenue, Columbus 16, Ohio

COMPRESSORS • PUMPS • MIXERS • HOISTS • PAVING MACHINERY

SEWERAGE AND WASTE TREATMENT

End Root Problems With Root-Proof Sewers

107. Troubles caused by roots and corrosions in house connections can be eliminated by the use of root-proof Bermico sewer pipe. Full details on this smooth, waterproof, tight-sealing pipe available by checking the coupon, or write to the Brown Co. Dept. PW, 150 Causeway St., Boston 14, Mass.

Data on Rotary Distributors For Sewage Treatment

118. Data on Infilco rotary distributors which feature low head requirements, uniform distribution, streamline design, double seal against sewage loss, and corrosion resistant construction, will be found in Bulletin 6400. For your copy, use the handy coupon or write Infilco Inc., Box 5033, Tucson, Ariz.

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, % Editor, Public Works, 310 E. 45th St., New York 17, N. Y. Check the coupon and we will forward your request.

Valuable Booklet on Porous Diffuser Plates and Tubes

21. A helpful 20-page booklet published by the Norton Co. is a complete guide for the selection of porous media for installation in activated sludge plants. Full data for the designing engineer is provided by careful detailing of physical characteristics of plates and tubes. Maintenance of porous media also is discussed at some length. For your copy of Form 1246, write to the Norton Co., Dept. PW, Worcester 6, Mass., or use the coupon.

How Cities Clean Sewer Lines From Street in One Operation

25. In a helpful 28-page handbook of sewer cleaning methods and equipment the makers of OK Champion sewer cleaners give full details of power and hand operated models. Also included are data on expansion buckets that take dirt from sewer to street in one operation, root cutters and other accessories. Get your copy by checking coupon. Champion Corp., 4752 Sheffield Ave., Hammond, Ind.

A Handbook of Sewer Cleaning Equipment and Methods

46. A new, fully illustrated 40-page booklet shows every sewer cleaning operation with "Flexible" tools. Includes data on the fast and easily operated new SewerRodeR and full engineers' specifications for power bucket machines. For your copy write Flexible Sewer Rod Equipment Co., 9059 Venice Blvd., Los Angeles 34, Calif.

How to Dig Low Cost Trench Under All Conditions

61. The Barber-Greene Runabout ditcher features hydraulic control of crowding speed, independent of bucket line speed, to provide maximum digging efficiency under all soil conditions. One-man operation and mobility from job to job result in trenching at the lowest cost. Get Bulletin 705-A now for full details on this money-saving machine. Barber-Greene, Aurora, Ill.

Check This Service When Building Water or Sewage Plants

65. Experienced engineers and craftsmen of Municipal Service Company can help you by furnishing and installing mechanical equipment and piping for water and sewage plants. Nation wide service is available. Get full information on your current jobs by writing Municipal Service Co., M-1, 908 Grand Ave., Kansas City, Mo., or use the coupon.

Using Sewage Sludge Gas For Power Generation

90. Fairbanks-Morse dual fuel engines can operate on either sludge gas or oil to provide steady power output despite fluctuations in gas supply. Bulletins are available on several sizes to meet your needs. Write, giving exact requirements to Fairbanks, Morse & Co., Dept. PW, 600 So. Michigan Ave., Chicago 5, Ill., or use handy coupon.

Forms for Every Concrete Pipe Shape

95. In addition to this a complete line of forms for standard concrete sewer and drainage pipe, special forms for varied shapes of every type are listed in the Quinn Concrete Forms Catalog. Copies available by checking the coupon, or write direct to Quinn Wire and Iron Works, 1621 12th St., Boone, Iowa.

Construction and Engineering Service For Water and Waste Systems

97. In addition to their nationally-known water and sewer system rehabilitation services, the Pittsburgh Pipe Cleaner Co., 133 Dahlem St., Pittsburgh 6, Pa., is now prepared to furnish complete engineering and construction service, including surveys, tests, design and construction. A full and concise description of these services will be found in an attractive new folder. Get your copy by checking coupon.

Need Low-Cost Air For Sewage Treatment?

122. New 20-page booklet shows operating and construction features of Rotary Positive Blowers engineered to fit your needs. Air for activated sludge, water treatment; constant vacuum for filtering. Bulletin 22-23-R-13 gives details. Roots-Connersville Blower Corp., 510 Poplar Ave., Connersville, Ind.

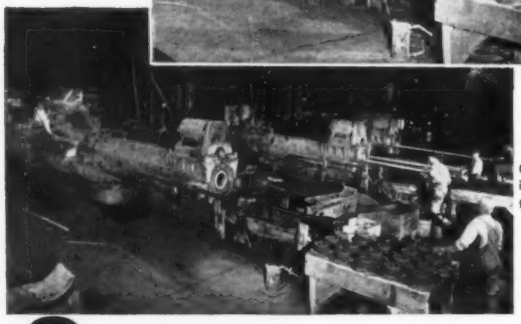
Sewer and Water Pipe Cleaning Service Can Save You Money

149. Your sewers and water pipes will be cleaned by experienced crews using modern, mobilized equipment when you take advantage of the fast, efficient service offered by Ace Pipe Cleaning Contractors, Inc., Kansas City, Mo. Don't neglect proper sewer sanitation or clogged water lines; let specialists do the job for you. Make a start today by getting the profusely illustrated bulletin which describes the Ace services. Check the coupon now.

Book Tells How to Control Root Stoppages

249. Details on the proven use of copper sulfate to control root and fungous growths in sewers are contained in a brand-new book published by Phelps Dodge Refining Co., 40 Wall St., New York 5, N. Y.

Close-up view of pulling a pipe from centrifugal casting machine.



General view showing three centrifugal machines in operation.

2 PIPE PER MINUTE

Pipe making "ain't what she used to be." It is vastly improved. More than 2 Cast Iron Pipe per minute are turned out by McWane-Pacific DeLavaud Centrifugal Pipe Foundries. At these pipe shops you see modern automatic machinery at its highest development in the pipe industry. A great centrifugal machine acts almost human. Each second trip the machine makes across its bed, a complete cast iron pipe rolls out. The machine pours its own iron and casts a pipe automatically—18' long, a true circle in diameter and absolutely even in wall section throughout. The process is a fascinating operation. Come and see it sometime.

McWANE Cast Iron Pipe Company
Birmingham, Ala.
Pipe Sizes 2" thru 12"

Sales Offices

Birmingham 2, Ala.	P. O. Box 2601
Chicago 1, Ill.	333 North Michigan Ave.
New York 4, N. Y.	80 Broad Street
Kansas City 6, Mo.	1006 Grand Avenue
Dallas 7, Texas	1501 Mercantile Bk. Bldg.

PACIFIC STATES Cast Iron Pipe Co.
Provo, Utah
Pipe Sizes 2" thru 24"

Sales Offices

Provo, Utah	P. O. Box 18
Denver 2, Colo.	1921 Blake Street
Los Angeles 48, Cal.	6399 Wilshire Blvd.
San Francisco 4, Cal.	235 Montgomery St.
Portland 4, Oreg.	501 Portland Trust Bldg.
Salt Lake City	Waterworks Equip't Co.

Comminutors for Automatic Disposal of Coarse Sewage Solids

152. The problems connected with disposal of coarse sewage solids are eliminated by clean, odorless, automatic Comminutors. Full engineering data show the proper model for every size plant and furnish details of hydraulics and typical installations. Chicago Pump Co., 2348 Wolfram St., Chicago 18, Ill.

Data on Single Stage Sludge Digestion Unit

163. High capacity mixing and ample gas storage space are provided in the single stage digester type MA. Bulletin No. 6591 describes the unit and tells how it works. Photographs, drawings and useful tables of sizes and design data are included. Unit is available for tanks from 20 to 50 foot diameters. The Dorr Co., Barry Pl., Stamford, Conn.

Data on Design of Grit Collectors and Washers

202. Grit collection and separation of organic materials from settled grit is described in Link-Belt Bulletin 1942. Typical installations are shown, and design data is provided, together with specifications. Use coupon for copy, or write Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

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WATER WORKS

The Modern, Streamlined Elevated Tank

32. A new 8-page bulletin describes the Watersphere, a modern elevated water tank of welded steel construction for general service gravity water pressure and fire protection. Construction details, illustrations of typical installations and table of standard sizes from 25,000 to 250,000 gallons capacity are included. Check the coupon. Chicago Bridge & Iron Co., 2115 McCormick Bldg., Chicago 4, Ill.

Is Your City Metered 100%

33. 100% metering as practiced by many cities requires accurate, dependable meters with interchangeable parts. Cut-away views of every part, capacity and size data are all included in handsome American-Niagara water meter booklet available from Buffalo Meter Co., 2920 Main St., Buffalo 14, N. Y.

Engineering Data on Diatomite Filters

44. Detailed information and typical plans of Sparkler diatomite filters for swimming pools of municipal water systems is available to engineers and municipal officials. These filters feature self-cleaning filter elements which cuts wash water to a minimum. Get this material now by using coupon. Sparkler Manufacturing Co., Mundelein, Ill.

The Turbidimeter Without Standards

51. The Hellige Turbidimeter is designed for accurate measurement of water turbidity, sulfate determinations, and measurements of suspended solids and colloids in general. No standards must be prepared for use with this instrument. Detailed description of working principle and the instrument itself covered in Catalog 8000-A, available from Hellige, Inc., Dept. PW, 3718 Northern Blvd., Long Island City 1, N. Y. or by checking handy coupon.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Tested Jointing Materials

102. "Hydrotite" is a self-caulking, self-sealing joint compound for bell and spigot pipes. For data book and sample write Hydraulic Development Corp., 50 Church St., New York, N. Y.

Reference Catalog for Valves, Fittings and Hydrants

72. A complete line of gate valves for all services, standard flanged and screwed fittings, and the Kennedy "Safetop" fire hydrants are fully described in Catalog 63 of The Kennedy Valve Mfg. Co., Elmira, N. Y. All engineers who specify valves, fittings and hydrants should have this valuable catalog for ready reference. Check the coupon.

Factors to Consider in Elevated Tank Selection

80. An interesting discussion of the factors to be considered for selection of elevated capacities and sizes, required fire flows and other useful data are included in a bulletin on elevated water storage published by Pittsburgh-Des Moines Steel Co., Neville Island P. O., Pittsburgh 25, Pa.

Pressure Pipe That Retains Capacity

106. Several bulletins describing the construction of pressure pipe, list of installations, carrying capacity tests, making service connections under pressure; and detail descriptions of several installations. Lock Joint Pipe Co., Box 269, East Orange, N. J.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

Handy Calculator for Cast Iron Pipe

175. With the handy Cast Iron Pipe Calculator you can determine at a glance the class, weight and dimensions of bell and spigot pipe. This slide-rule type calculator is absolutely free. Use coupon or write R. D. Wood Company, Public Ledger Bldg., Philadelphia 5, Pa.

(*Continued on page* 32)

UNIVERSAL

is ready for defense too, with plants and portable pipe-making equipment ready to go anywhere!

Our portable equipment doesn't move as fast as our jet fighters, it's true. But, we do have the site-cast pipe making equipment ready to go to work on your municipal, industrial or defense jobs.

Twenty-three Universal plants and affiliates are located throughout the Eastern United States. If it becomes impossible, because of transportation cost, to handle any job economically, our site-cast portable equipment is ready to go.

Contact the home office or any one of the plants listed below, for full details.

Contractors doing business abroad!

All the necessary pipe-making machines and accessory equipment can be supplied you for contracting jobs outside the continental limits. Ask for details.

UNIVERSAL CONCRETE PIPE CO.

Home Office: 297 S. HIGH ST., COLUMBUS 15, OHIO

UNIVERSAL CONCRETE PIPE CO. PLANTS—Decatur and Dothan, Ala.; Tampa, Fla.; Atlanta, Ga.; Kenvil, N. J.; Binghamton, Port Washington, Rochester and Syracuse, N. Y.; Columbus and Zanesville, Ohio; Norristown and Pittsburgh, Pa.; Nashville, Tenn.; Clarksburg, New Martinsville and Wheeling, W. Va. UNIVERSAL AFFILIATES—Concrete Pipe Co. of Ohio with plants in Cleveland, Youngstown and Sandusky, Ohio and Erie, Pa.; Florida Concrete Pipe Co., Ocala, Fla.; Dixie Concrete Pipe Co., Louisville, Ky.

1 USE TFF INSTITUTE SPECIFICATION UNDERDRAINS

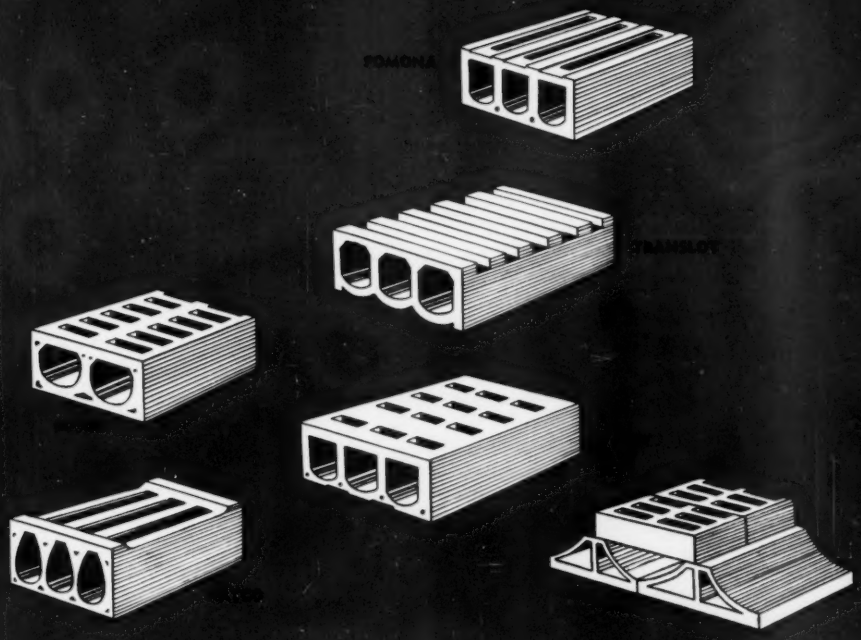
The scientific design of these *vitrified clay filter bottom blocks* insures trouble-free operation for the life of the filter. They have large top openings. That means proper ventilation of all filter media and free discharge of the filter effluent at all times. They have smooth run-off channels. That means quick drainage and no clogging even with years of operation. The blocks are light in weight, self-aligning and easy for unskilled labor to lay. After they have been laid they are strong enough to work on and to support even very deep filter media.

These modern underdrain blocks will carry applications up to 50 MGAD. They are best for all kinds and shapes of filters. They are used everywhere better operating results are desired.

Use them to insure best results from your next trickling filter. Give it a *specification* floor. Use TFFI *vitrified clay filter bottom blocks*. For full engineering details write any member of this Institute today.

Need more facts about advertised products? Mail your Readers' Service card now.

Trickling Filter Results



2 USE GOOD EQUIPMENT

Average flow at the south's largest Biofiltration system in Orlando, Fla., is 8 MGD . . . peak flow 16 MGD with a 5 day BOD of 325 ppm. Equipment installed includes four 120′ dia. Dorr S-7 Clarifiers and four 120′ dia. Dorrco distributors for primary and secondary treatment. And to insure best operating results for this fine equipment the filters have *specification* floors of *Vitrified Clay Filter Bottom Blocks.*

TRICKLING FILTER FLOOR INSTITUTE

Ayer-McCarel-Regan Clay Co., Brazil, Ind. · Bowerston Shale Co., Bowerston, Ohio · Industrial Materials Co., Philadelphia 34, Pa. · Texas Vitrified Pipe Co., Mineral Wells, Tex. · National Fireproofing Co., Pittsburgh 22, Pa. · Pomona Terra-Cotta Co., Pomona, N. C. · W. S. Dickey Clay Mfg. Co., Kansas City 6, Mo.

Now's the time to mail this month's Readers' Service card.

GET THOSE WEED ROOTS!

GO TO THE ROOT OF YOUR WEED PROBLEM WITH THESE DOLGE PRODUCTS

Please write for descriptive literature explaining how these tested DOLGE products can best be used for your weeding requirements.

DOLGE SS WEED-KILLER

Where no vegetation whatever is desired such as your parking places and walks. Penetrates deep down to plant roots and *kills*. Sterilizes the soil, preventing normal sprouting of wind-blown seeds. Weeding the thorough, modern *chemical* way eliminates backbreaking toil and saves the cost of many labor-hours.

E.W.T. SELECTIVE WEED-KILLER (2-4-D)

The *efficient* way to control weeds on your seeded areas. Works its way down into the roots of brush, dandelion, plantain, poison ivy, ragweed, sumac and other obnoxious plants, *but does not injure most turf grasses.*

Dependable DOLGE

WESTPORT, CONNECTICUT

GUNITE

SPECIALISTS

PRESTRESSED TANKS
SWIMMING POOLS
RESERVOIRS
SEWERS
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EASTERN GUNITE COMPANY

ELKINS PARK, PA.

FOR REPAIRING BELL AND SPIGOT JOINT LEAKS...

SKINNER-SEAL Bell Joint Clamp for stopping bell and spigot joint leaks under pressure. Gasket is completely sealed: at bell face by Monel Metal Seal band—at spigot by hard vulcanized gasket tip.

AND BROKEN MAINS

SKINNER-SEAL Split Coupling Clamp. One man can install in 5 to 15 minutes. Gasket sealed by Monel band. Tested to 800 lbs. line pressure. A lasting repair. 2" to 16" incl.

M. B. SKINNER CO.
SOUTH BEND 21, INDIANA, U.S.A.

Water and Sewage Plant Data Easily Transmitted

127. In an 8-page bulletin, No. 230-H4, you will find complete information on the Chronoflo Telemeter, which makes possible the transmission of metered data and controls over a simple two-wire electrical circuit for unlimited distances. Be sure to check the Chronoflo for flow measurement, pump controls, and all other distant indications. Builders-Providence, Inc., 356 Harris Ave., Providence 1, R. I. Check coupon for your copy.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Faster Pipe Laying With Precaulked and Threaded Joints

148. McWane 2" cast iron water pipe with threaded joints and precaulked bell and spigot pipe are described in folder WM-47. Additional data on 3" to 12" centrifugally cast pipe and fittings in folder WL-47, both issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala.

Helpful Data on Well Water Systems

173. A comprehensive, 48-page book on Layne Water Well Systems covers gravel wall wells, underreaming, cemented walls, rock wells and other well types. Applications of shutter screens and vertical turbine pumps are shown, together with water treatment and conditioning equipment. Ten pages are devoted to useful engineering tables and measurement data. Check the coupon today or write Layne & Bowler, Inc., Dept. PW, Memphis 8, Tenn.

Locate Mains and Services Without Digging

186. A 16-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes and valves by electronic means. Proper manipulation also determines depth of cover. Battery operated unit is readily carried by one man. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 52-page Catalog 833. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use coupon or write Jeffrey Mfg. Co., 947 N. 4th St., Columbus 16, Ohio.

Are You Ready Now To Make Main Repairs?

214. Broken water mains can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Get Skinner Catalog 41 now—this handsome 40-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. Just check the handy coupon for your copy. M. B. Skinner & Co., So. Bend 21, Ind.

Does Your Water Works Have Standby Power?

224. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co., 208 So. La Salle St., Chicago 3, Ill.

General Catalog on Measuring and Controlling Equipment

272. The full line of Simplex equipment for the measurement and control of liquids and gases in water and sewage plant installations is illustrated and described in detail in 28-page Catalog 002. Every engineer should study the design data in this helpful booklet. Write Simplex Valve & Meter Co., 68th & Uplands Sts., Philadelphia 42, Pa., or use the coupon.

Installation Guide for Transite Pressure Pipe

192. A conveninent, pocket-size book of 115 pages covers the whole job from receiving and handling pipe to pressure and leakage tests of finished lines. Over 100 drawings show important operations, and the text tells both how and why. Copies are available from Johns-Manville, Dept. PW, 22 E. 40th St., New York 16, N. Y.

Emergency Chlorination and Main Sterilization

213. Get data on portable emergency chlorination units designed to save time in cases of broken mains or substitute water supplies. Use coupon to order copies of publications 22-C; 58-C; and 408 from Wallace & Tiernan Co., Newark 1, N. J.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in a convenient booklet offered with the compliments of U. S. Pipe and Foundry Co., Burlington, N. J. Get your copy by checking the coupon.

Corrosion Protection For Water Works

280. Steel pipe lines, elevated tanks, treatment plant equipment and all other steel structures subject to rust, tuberculation and attack by aggressive soils can be protected by long-lasting Bitumastic enamels. Send for bulletins today so that you can specify the right coating for your job. Use coupon or write Koppers Co., Tar Products Div., Dept. 255T, Pittsburgh 19, Pa.

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STREETS AND HIGHWAYS

How the Mobil-Sweeper Can Improve Street Sweeping

23. Sweeping costs can be cut with the new Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to The Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

Building State, County and Township Roads

47. The story of better roads for fewer taxpayers' dollars is told in an excellent bulletin describing "Caterpillar" diesel motor graders. These versatile units serve state, county and township bodies all year long on construction, maintenance and snow removal. Get bulletin D831 from Caterpillar Tractor Co., Peoria, Ill.

How to Keep Your Loader On the Job

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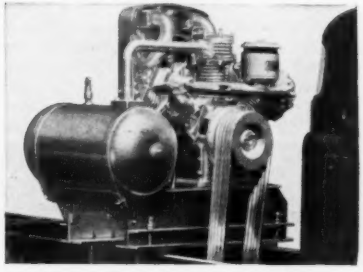

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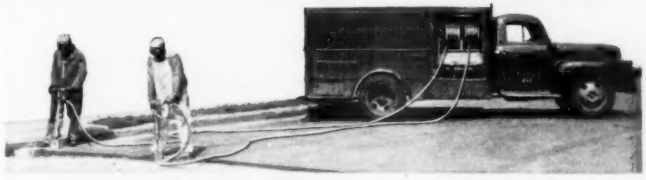

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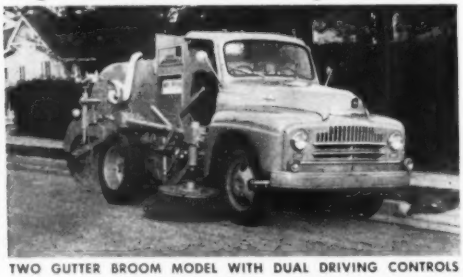

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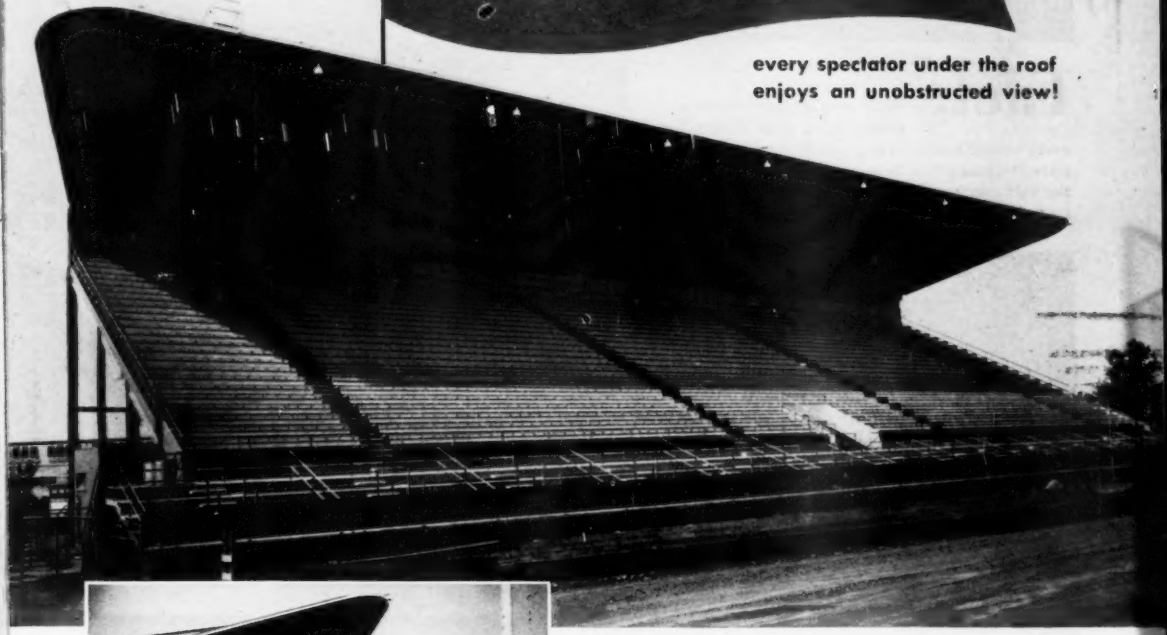

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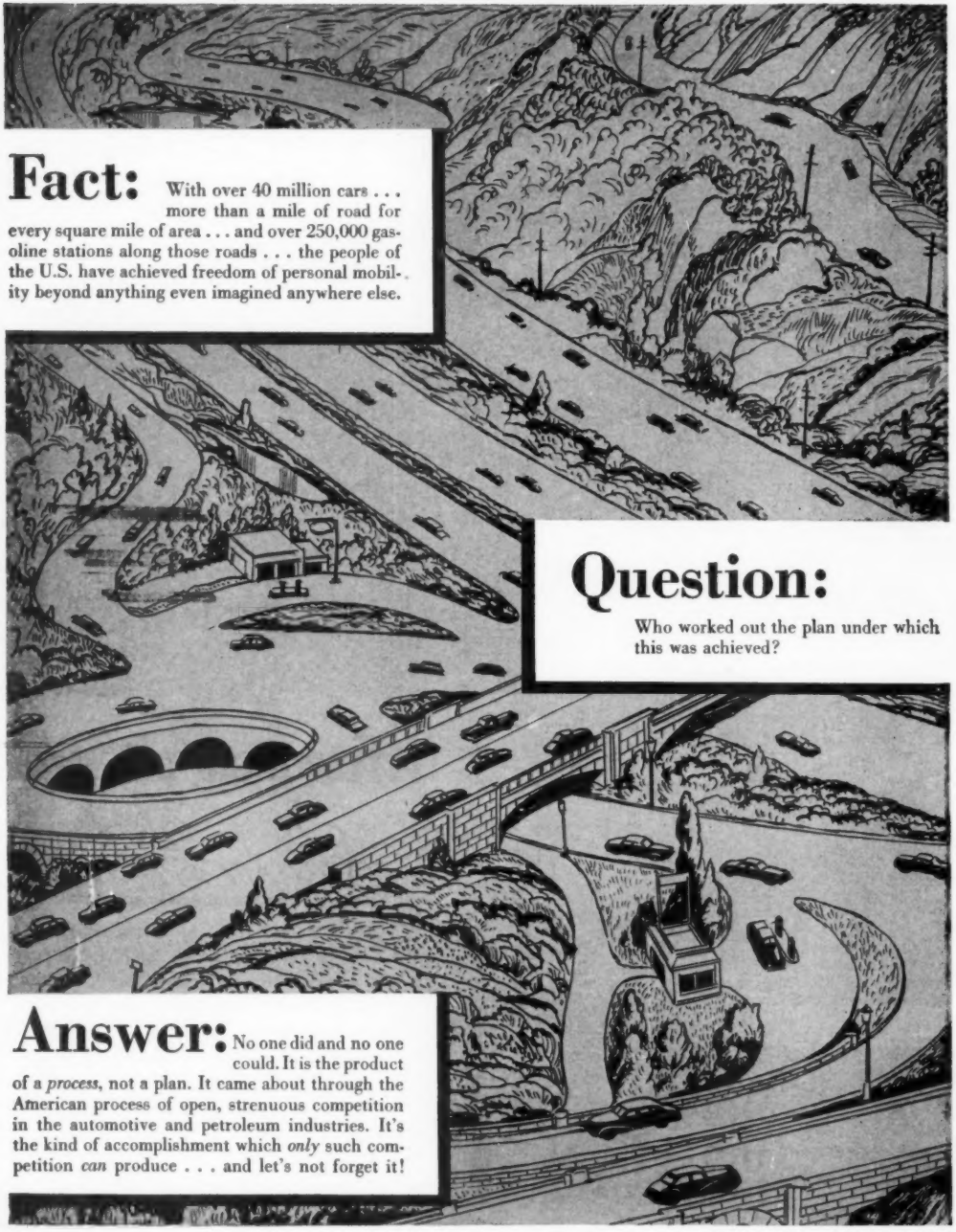

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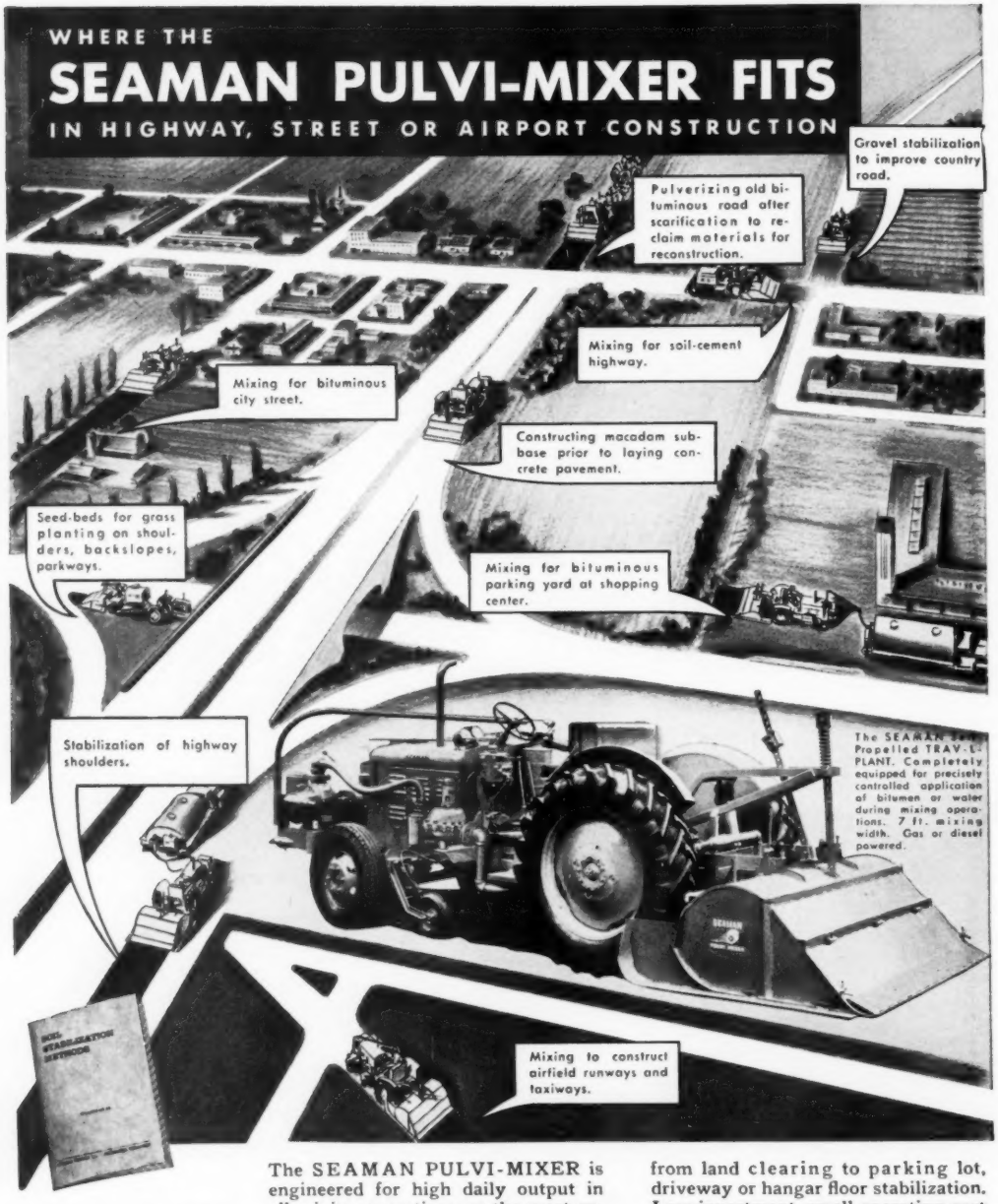
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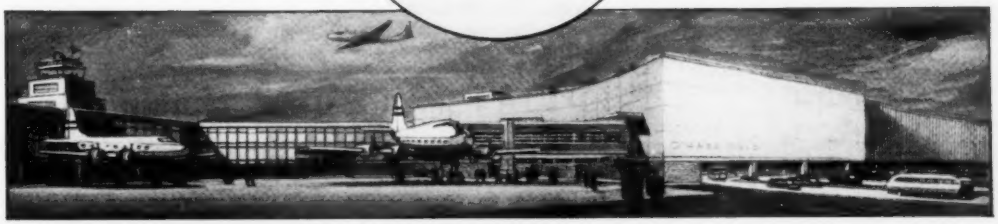
PUBLIC WORKS Magazine

MARCH 1952



● *FUTURE development of O'Hare Field, showing terminal structures, as conceived by the designers.*

OUR LARGEST AIRPORT

PHILIP L. HIRSCH

O'HARE International airport—largest commercial airport in the United States—is now being built 18 miles northwest of Chicago's "loop." The site, an ex-cornfield, ex-airplane proving ground used by the Douglas aircraft company during World War II and by the Army air force since then, covers 6,325 acres. Initially, it will handle 120 planes an hour. When all four stages in the field's master construction plan are finished, O'Hare will be able to handle 360 plane movements an hour, or one every 10 seconds. This capacity is more than four times the number of planes now handled by any commercial airport in the nation.

O'Hare will be ten times the size of Chicago's existing air terminal, Midway airport, formerly Municipal airport. Municipal was large enough in 1936 when 100,000 airline passengers checked in and out of the city; but by 1946, Chicago's annual airpline passenger traffic had reached 2.5 million and had turned the field into a bottleneck for both planes and passengers.

City officials, realizing the situation and sensing that air traffic was destined to grow, began planning the airport, aided by state and federal agencies.

When O'Hare is opened in 1954, after Stage 1 has been completed at a cost of $37 million, the field will be big enough to handle the 7,840,000 air passengers expected to pass through the city. By 1965, it will be expanded to accommodate the 15,650,000 air passengers expected at that time, according to conservative estimates.

Location Factors

An important factor in selection of the field was that it would be easily accessible from the loop. Chicago and Cook county, with the aid of the federal government, are currently engaged in a multi-million dollar superhighway construction program. When the first of these highways is completed next year, O'Hare will be 35 minutes from the center of the city by bus, taxi, or auto. Another, more direct route, when completed a few years later, will cut this time to 25 minutes.

Incoming traffic will be funneled into a two-story terminal building with five finger-like projections. Adjoining the terminal, a 6,500-car parking lot is planned.

The entrance roadway will be divided into sections for truck and auto-bus traffic. Passengers will alight in the center of the terminal on the ground floor. Trucks will bring freight direct to the planes over roads extending through the fingers.

Concessions and airline offices were located after careful studies of walking distances and traffic volume. The result was a plan which has these main features:

Both passengers and visitors are funneled from the ground floor unloading station via escalator to a large concourse area on the second floor. Here, the concessions are located. While visitors are drawn to observation decks adjoining the concourse, passengers move along a short, relatively unobstructed path to the airline offices in the fingers, for pre-flight processing.

One feature of this plan is that all passengers and visitors will walk an average of only 735 feet. This distance is a vast improvement over comparable airports or even the best large railroad terminals, where the average ranges from 1,000 to 2,000 feet.

long. This distance is some 50 percent greater than runways presently in use at similar fields. For example, the longest runway at Midway airport is 5,730 feet.

The runways are designed in the form of tangents to a circle formed by the aprons and taxiways. At the center of the circle is the terminal building.

Design Advantages

One of the primary advantages of this design is that it eliminates long taxi distances. When incoming planes reach the end of the runway, they are a short distance from the terminal. On the conventional field, equipped with parallel runways, one end of the runway is usually as far away from the terminal as the other.

Another advantage of the tangential pattern is that approach and takeoff paths will not pass over the terminal. Also, each runway is laid out in a different direction; this factor provides more room for planes approaching the field or taking off than the parallel plan does.

Since the runways will not intersect, they can be used simultaneously, eliminating the frequent stackup of planes on the ground and in the air which is now a common occurrence at many fields.

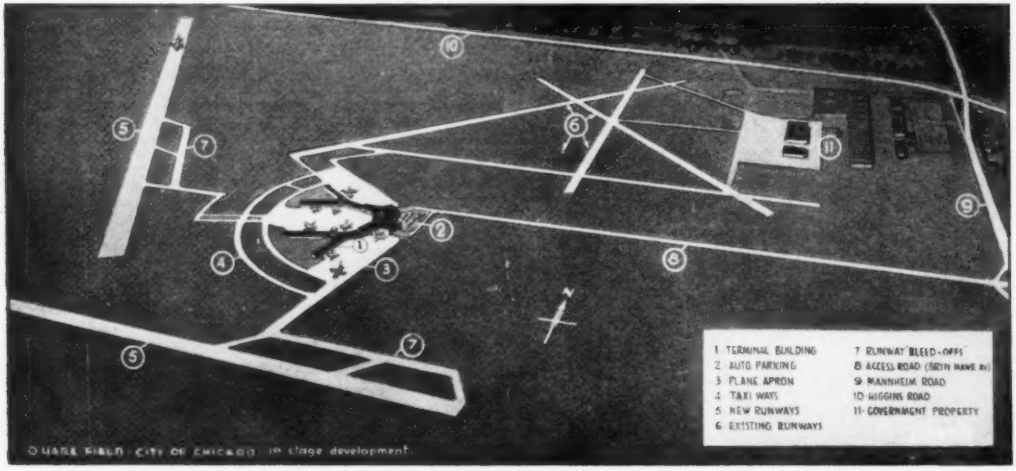
Two of the runways, each 7,800 to 8,100 feet long initially, will be built during Stage 1. These, with four existing runways, will provide the facilities to handle 120 planes an hour under normal conditions.

Instrument Landing Service (ILC) and Ground Controlled Approach (GCA)—electronic landing aids used in bad weather—will be provided on both of the new runways and on one of the existing runways. With these facilities, during adverse weather, the field will be able to handle more than twice as many planes as any other commercial airport in the world. When the other four runways are built, they will be equipped with ILS. As a result, the influence of weather on O'Hare's operations will be virtually eliminated.

Although the two new runways included in Stage 1 will be about 8,000 feet long, there is enough land to extend them, as well as the other four, to at least 17,000 feet. This factor is important insurance against early obsolescence of the field.

O'Hare's runways will conform to standards set up in 1947 by the Civil Aeronautics Authority for international-type fields. This type of runway is designed to accommodate the largest planes now in service —the Boeing stratocruiser for example—with additional room left for even bigger aircraft presently being developed.

The CAA standards were an important offshoot of O'Hare's development. They were written after a request by officials in charge of developing O'Hare, who were afraid that in spite of all their precautions, rapid advances in airplane design would make O'Hare obsolete before it could pay for itself.



● ***LAYOUT of O'Hare Field, showing new and existing runways, taxi-ways and other features.***

Another feature is the way in which passengers will board planes at O'Hare. Instead of walking across the apron to a portable stairway or ramp, they will walk aboard direct from the second-floor airline offices on aluminum, telescoping bridges. The bridges not only shelter the passengers, but also save them time and walking distance.

Two of the five fingers of the terminal building are included in Stage 1. They will provide 24 loading gates, 150 feet apart. This distance allows enough room for larger planes than are now in service. Also, the design is flexible enough to permit extension of the fingers at a later date. When all five fingers are built, 94 loading stations will be provided.

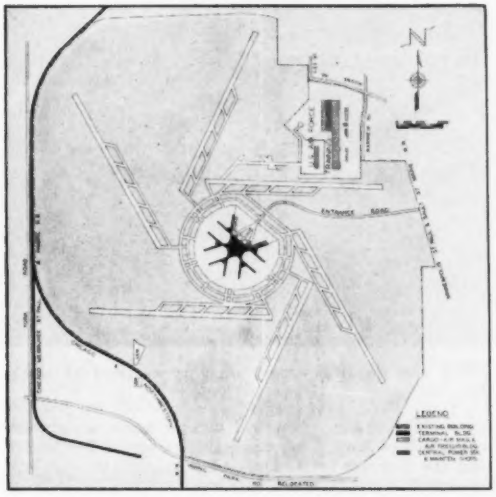
O'Hare's master plan calls for six runways, each 9,300 to 9,600 feet

Runway length, width, and load standards were developed by CAA for feeder, local, express, deluxe, international, and international express airports. The effect of this action was to place airplane development in step with airport development. Air carriers obtained an idea of the maximum-sized plane that could be accommodated by a particular airport; on the other hand, airport developers learned what type of runway was needed to furnish their cities with a particular type of service.

Another CAA policy also had an important part in the development of O'Hare field. Originally, 10 runways had been planned at the field. has been to eliminate the need of extra runways solely for wind coverage. Because of the new landing gears, an estimated $17.5 million was saved at O'Hare.

The ten-runway plan required diversion of the Chicago and Northwestern railroad tracks for a distance of 7.2 miles. A new railroad grade separation was required and a new street overpass. The adoption of the six-runway plan permitted the shortening of this diversion by 1.3 miles and eliminated the new grade separation and overpass. Savings on this work alone have been estimated at more than a million dollars.

The new plan also eliminated the



● ***MASTER plan, showing completed appearance.***

● ***FIRST stage construction program for field.***

Some of these were needed to counteract high crosswinds. For example, the DC-3, equipped with a two-wheel landing gear, cannot land if the wind at 90 degrees to the runway is more than 20 miles an hour.

Formerly, extra runways were built which permitted the plane to land at an acute angle to these winds. This plan reduced the 90-degree component below the maximum velocity. But about the time that the runway standards were issued, it was learned that the tricycle landing gear, now installed on big planes by virtually all carriers, enabled a landing in a higher crosswind. A newer type "caster" landing gear, presently being tested, will increase this maximum allowable crosswind further.

The result of these developments necessity of purchasing subdivisions in the northeast, southwest, and southeast corners. A total of 570 acres was pared from the original site, at a saving of a million dollars.

But the reduction in the number of runways provided the greatest cost reduction. Even a 6,000-foot runway costs about $2,500,000 when the expense of land, drainage, paving, and lighting is included. At O'Hare, where runways 9,300 to 9,600 feet long are to be built, this saving will amount to approximately $15 million.

The field's total revenue the first year will be about $2.7 million. Revenue will jump to an estimated $5.4 million by 1965, when the field is operating at peak capacity. Part of this income will be paid by terminal concessions—notions stands, restaurants, the parking lot, and the observation deck. The money will be paid as a percentage of annual income, rather than on a rent basis. Thus, the expected increases in air travel will benefit the city as well as the concession owners.

City officials are now negotiating for a $15 million revenue bond issue needed to complete Stage I and open the field. Already Chicago has contributed $10.5 million to the project. Illinois has given $2,970,000, and the federal government has granted $6.4 million. Approximately $2 million more is expected from the state and federal governments next year.

The city money came from a $14 million bond issue, payable from general funds, which was floated in 1945.. About $3.5 million was spent on other fields in the city. State aid was furnished under a policy of matching grants paid by local governments for the construction of airports. Federal money was granted under the National Airport Act, which provides aid totalling 50 percent of construction costs and 25 percent of land costs.

When this money has been spent, Chicago will have an airport capable of meeting the demands of an age conceded to be just around the corner, in which the airplane will be a travel medium of gigantic proportions. Experts from all the major airlines and government officials who worked on design of O'Hare for two years say the airport will be usable for at least twenty to thirty years.

Portland's Unusual Sewage Disposal System

GUY BROWNING ARTHUR

AFTER two more years of construction, Portland, Oregon, will start up a most unusual sewage disposal plant. It is laying a main interceptor through the length of the elongated city, and for 16,589 feet this is in a tunnel which is, in places, 160 ft. underground. The effluent of the primary treating plant will discharge into the Columbia River, which is super-saturated with oxygen by its turbulence, and has a volume and velocity capable of taking all the sewage with no treatment. The entire cost of the new system will be about $17,000,000.

The conditions which brought about this project were building up for many years, with sporadic efforts toward correction. In 1939 the committee which had finally been appointed, consisting of R. H. Corey, Wellington Donaldson, Carl E. Green, and Abel Wolman, made a report. This report is the basis for the present construction.

To understand the findings of the Committee it is necessary to know that Portland is a narrow city, built along the Willamette River for miles, with its northern border along the lowlands of the Columbia River. The Willamette comes down from high country, and is a beautiful, clear stream until it reaches the industrial plants in the valley. From there on it becomes more and more polluted until, when it reaches Portland, it is so deficient in oxygen that it can scarcely support fish life.

At Portland, which is a world port, with ocean steamers coming to its wharves, the stream is 800 ft. wide and 50 ft. or more deep, but with no tide. About three miles beyond the northern border of the city the Willamette empties into the Columbia. Near the confluence there are several sloughs, the largest of which, Columbia and Oregon, are considerable bodies of water.

● ***CONSTRUCTING the digester floor, showing method of work.***

The Committee found: "The Willamette River during periods of low flow, normally during the summer months, is heavily polluted, unsafe for bathing, unsuitable for recreation purposes, and impossible for sustained fish and aquatic life. The City of Portland is primarily responsible for this condition." And, "it (the river) should be relieved of a large part of the domestic and industrial load discharged into it before it reaches the city.

"The pollution of the river by these wastes has converted it and the Columbia Slough into objectionable open sewers." It has "reached such a stage of organic degradation as to prevent most fish life, produce objectionable odors during the summer, and interfere with the normal uses of the river."

The frequent mention of fish life reflects the great value of the salmon fisheries in the Pacific Northwest. To hinder the coming of the salmon at spawning time is a misdemeanor. So, stream pollution becomes an affair of state. It is likely that the issue of industrial pollution will become more acute when the domestic sewage of Portland is no longer discharged into the Willamette River.

The Committee found that, during low stages of the Willamette, it takes 7.6 days for its waters to pass through the length of the city and out to the Columbia.

Portland adds its waste to the Willamette through 50 sewer outlets, some of them 10 ft. in diameter. There is now no treatment whatever. The system carries both the storm flow and domestic sewage. The amount of storm water is not that of a flat area, but of a valley which receives the run-off of the enclosing hills, so the volume is greater than that common to most city areas.

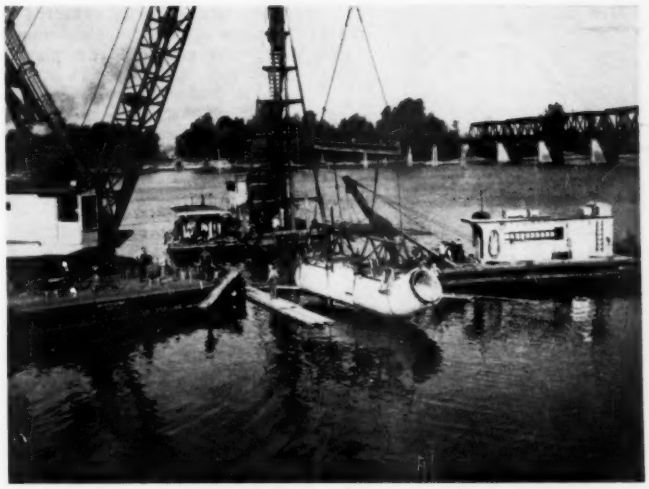
Design of the New System

The Wolman report states that the entire volume of Portland's sewage could be discharged into the Columbia River with no treatment. That is because the Columbia is a mighty stream, carrying a vast volume of water at high velocity, and

super-saturated with oxygen. Its minimum daily flow, over a 60-year period, is 35,000 cfs. Its minimum with regulation will be 80,000 cfs and in the summer it will be over 100,000 cfs. This reversal of the usual variation between summer and winter flow comes from the melting of snow and ice in the mountains during the summer. The lowest flow is in the winter.

While the Wolman Committee says no treatment is really necessary it draws back from that unusual conclusion with a recommendation for primary treatment. This recommendation, which was accepted and forms the basis of design for the new plant, immediately suggests striking departures from common practice. Some of these are the omission of any provision for holding the sludge for drying and use as fertilizer, for incineration of screenings, or for use of chemicals.

The plant is designed for the estimated requirements of 1970. About half the storm water will be taken at the start, but this amount must decrease as the population increases. Also, as much of the industrial waste will be taken as possible, but this amount must also decrease as the domestic sewage load increases.



● ***LAYING a section of concrete pipe under Columbia Slough***

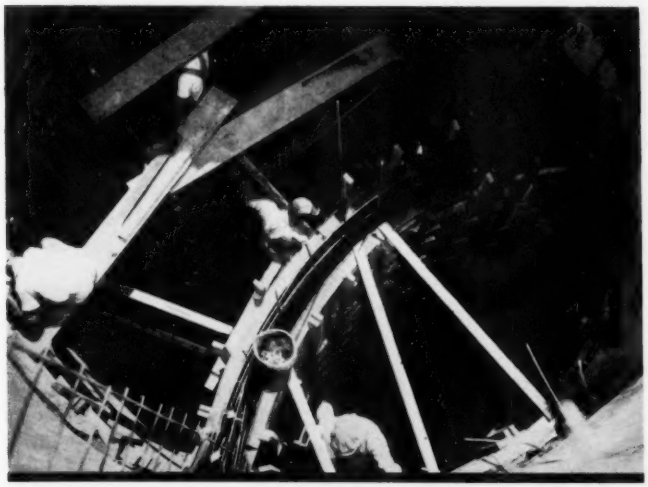
The new system is properly divided into two parts for consideration: the collecting system, and the treatment plant with its outfall.

A number of decisions had to be made preliminary to starting any design, such as the one to take half of the storm water. Another was to use all of the present sewer lines, turning the domestic sewage into a main interceptor, and diverting the storm water to the river. Still another was to locate this main interceptor on a median elevation. This third decision must be explained.

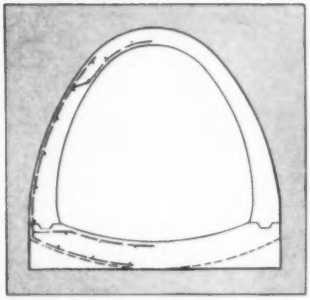
Local Topography Introduces Many Design Problems

Two characteristics of the land along the Willamette determined this choice. One is the rapid rise of the ground away from the river banks. This gives the city many steep slopes, and the better residence sections, on the west side especially, are on these slopes. Many of the finest residences are literally hung on the precipitous hillsides. Some are actually anchored by cables to huge concrete emplacements.

The other is the presence of old sloughs along the river. By talking to older residents, and consulting such records as could be found, the Committee learned that in early days the river was bordered by sloughs, which were essentially backwater reservoirs. As the city grew these were filled in with a remarkable assortment of filling material, ranging from sawdust and waste slabs from the many lumber mills along the river to city refuse and soil scraped off the higher ground. This filled-in land would



● ***SMALL pumping station designed with circular plan. This shows forming on wall dividing wet pit and chamber for automatic pumps.***



● ***TUNNEL** section of main interceptor is 8'6" by 8'6".*

be an unstable foundation for a main sewage collector.

The main reason for looking into this low location so carefully was, of course, the hope of handling all the sewage by gravity. But the nature of this low ground, together with the danger of flooding the interceptor in times of high water, ruled it out.

An alternate was a high location, but that would call for pumping all but a small part of the sewage. A median location was chosen as the most desirable from all points of view, though it means pumping 118 mgd of sewage once, and 7.2 mgd twice. The remainder, 57 mgd, will flow by gravity to the treating plant.

Tunnel for Main Interceptor

This main interceptor runs from the treatment plant on the northern border of the city, to the southern end, using some of the old sewers. Its route is underground most of the way, but it has to be carried across a few gulches on trestles or fills. The most costly part of its course is the tunnel through the peninsular watershed which runs back from the confluence of the Willamette and the Columbia. In this section it goes underground, in places 160 ft. below the surface, for 16,589.83 feet.

The tunnel section is semi-elliptical, 8'6" high and 8'6" wide. It was driven from both ends simultaneously, the center lines being about 1/4 inch apart at the joining. The cost of this section was $2,920,-402, or about $176 a running foot.

For getting the sewage from the west side of the city across the Willamette to the main interceptor, it was originally proposed to have three inverted siphons under the river. Two were eliminated by concentrating all of this sewage at the existing Ankeny Street pumping station, whence it is delivered to the main interceptor high enough to flow by gravity to the plant.

Two cast iron pipes, 30 in. and 42 in. in diameter, form the siphon. They have mechanical joints, and are laid in a trench in the bottom of the stream with about 10 ft. of cover. The river is so deep at this crossing that the pipes are 65 ft. below low water surface.

The old sewer outlets will continue to discharge storm water into the rivers, 50 of them into the Willamette, and 11 into the Columbia Slough, flowing into Columbia River. Diversion structures are installed to regulate the flow of storm water and to reduce the grit intake to the interceptor.

Pumping Installations

Except for the part that flows to the treatment plant by gravity, the sewage is lifted to the main interceptor by two large pumping stations and 11 smaller ones. The Ankeny Street station is typical of the larger. At present there are 5 pumps in this: three 30,000 gpm and two 10,000 gpm. One of the larger pumps is to be removed and replaced by two Peerless vertical pumps, increasing the total capacity of the station.

Each of these new units is to be driven by a double synchronous motor with two operating speeds. The smaller unit is to be a non-clog, and will pump 7.5 mgd at one speed, and 15 mgd at the other. The larger unit is to be a mixed flow pump, and will have operating capacities of either 20 or 35 mgd. The new units will normally pump to the east side main interceptor, while the others will pump storm water to the river, as they do at present. The new units will operate against a total dynamic head of from 45 to 56 feet.

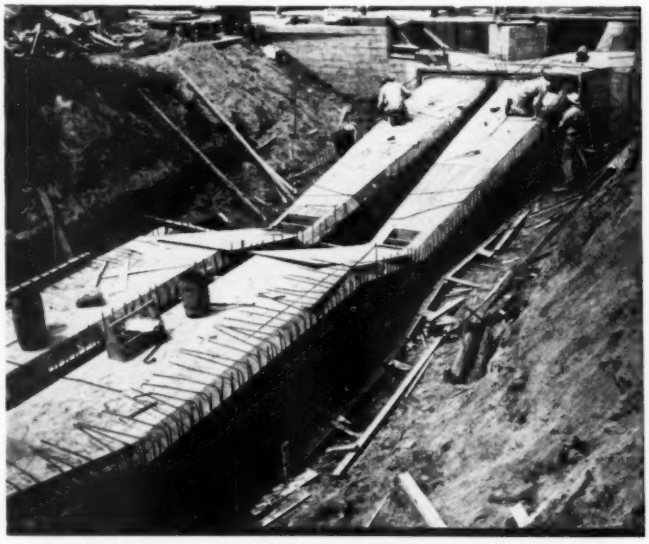
The 11 smaller pumping stations are to be fully automatic, requiring no attendant. Each one has one set of duplex units which automatically screen the sewage. Some have additional units to pump out excess flows caused by infiltration and storm water entering the sewer system. Where possible the storm flow units pump the water directly to the river.

Some of the small stations have two wet pits. The duplex units operate from one wet pit, and the storm units from the other. The storm pumps are non-clog units, and are to be protected by coarse screens with 2½ in. openings.

Treating Plant

The plan of operation of the sewage treatment plant is as follows: Sewage comes to the plant through the main interceptor, passing through Venturi tubes, which were cast in concrete on the job. The flow will be recorded by Leupold & Stevens meters. The tubes were designed by John W. Cunningham, who, with his Associates designed

(*Continued on page* 89)



● ***BUILDING** the forms for constructing the Venturi tubes.*

WATER WORKS and SEWAGE TREATMENT for BREVARD

● ***DIGESTER, sludge drying beds (shown at left) and primary sedimentation tank (at right).***

THE original water system serving Brevard, N. C., was inadequate in that storage capacity was limited to a total of 360,000 gallons and the distribution system piping was of small size. To remedy these, the city last year employed John J. Harte Co., Atlanta, Consulting Engineers. As a result of the engineer's recommendations, two 1,000,000-gallon prestressed concrete reservoirs were constructed and extensive additions were made to the water distribution system. A sewage treatment plant was also constructed.

The contract for the reservoirs was awarded to the Bowe Construction Co. of Augusta, Ga., but the actual construction of the tanks was by the Preload Corp. of New York. The two reservoirs are interconnected by a series of pipes which permits the use of either one of them, or of the existing 270,000-gallon reservoir, if it is necessary to place the others out of service for any reason. When not otherwise utilized, the old reservoir is retained for use as a settling basin. This reservoir was in poor condition and was reconstructed using gunite for repair.

The average water consumption in Brevard is 500 gpm, but the peak consumption is about 1,000 gpm. The flow from the streams constituting the city water supply is 670 gpm. During periods of peak demands in the past, the 360,000 gallons of storage (one 90,000 and one 270,000-gal. tank) was inadequate and left no reserve for fire demands. With the new reservoirs in service, storage totals 2,270,000 gals., which will supply the city's needs for 60 hours, even if the supply from the streams were completely stopped.

Distribution System Changes

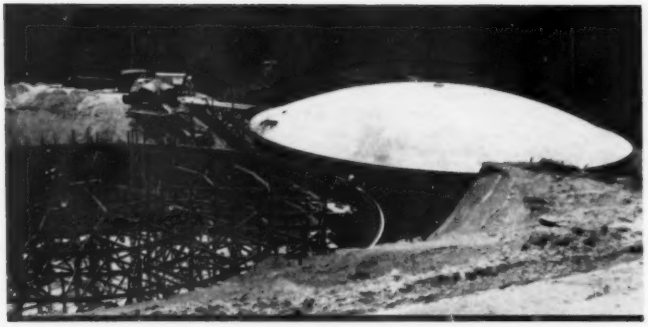
In addition to the increased storage facilities, the city undertook a broad-scale renovation of the distribution system. A 14-inch main was constructed from the reservoirs to the center of the city, and additional 6-inch and 8-inch mains were extended through the mercantile and principal residential areas. Pressures in many sections of the city are now twice as great as they were previously. In all, construction included 5,500 ft. of 14-inch pipe, 9,600 ft. of 8-inch, 17,700 ft. of 6-inch, 41 fire hydrants and 60,000 pounds of castings.

This new construction provides a cleaner and better water, a more abundant supply with lower fire insurance rates and much increased pressures. The water is brought to the city from King's Creek, in the Pisgah National Forest by cooperation with the U. S. Department of Agriculture, but there are also intakes on Norton and Bracken Creeks. The watershed area is forested and is well patrolled to prevent trespassing. Chlorination is the only treatment. The improvements included a new chlorinator building and installation of automatic chlorination.

Sewage Treatment

The city is located on a ridge between two drainage basins and there are, therefore, two separate collection systems for sewage. The northern system, which serves the greater portion of the commercial area, a zoned partly-active industrial area and a residential section, discharged through five separate outlets into King's Creek, which empties into French Broad River. The southern collection system, serving the remainder of the city, discharged through three outlets to the French Broad. Sewage is largely domestic, the small contributions of industrial wastes being unimportant.

It was decided to collect and pump the sewage south of the divide to the King's Creek area, install an interceptor in this valley, and provide primary treatment. The French Broad River receives considerable domestic and industrial waste and complete treatment was deemed unnecessary for the present. About



● *CONSTRUCTING the new reservoirs, showing forms in place.*

5.6 miles of sewers were necessary, ranging in size from 8-inch to 18-inch, and two pumping stations.

The basis assumed for the design of the plant provided for a population increase to 7,200 by 1970, with provision for a daily flow of 1.34 mgd. The plant consists of a bar screen, primary settling tanks, Parshall flume, chlorine detention tank and chlorinator, digester and sludge drying beds. The contract for construction of the sewers and sewage treatment plant was awarded to Boyd and Goforth Construction Co., Charlotte, N. C.

There are two primary settling tanks, each with a capacity of 9,700 cubic feet, providing 2.5 hours detention for the design flow. The single digestion tank provides 16,500 cu. ft. of volume, or about 2.5 cu. ft. per capita. The equipment for the primary tanks and for the digesters were furnished by Walker Process Equipment Co. Chlorinators are by Wallace & Tiernan.

To finance these improvements, $200,000 of water bonds and $300,000 of sewer bonds were sold.

John A. Ford, mayor of Brevard, and L. W. Dabney of John J. Harte Co., supplied the data on which this article is based.

Plastic Lined Sewer is 7 Miles Long

A vinyl plastic lined sewer pipe nearly seven miles long is being installed in Orange County, California. The reinforced concrete pipe is lined with "T-Lock Amer-Plate," a plastic sheeting developed and manufactured by the Amercoat Corporation.

The plastic sheets, approximately 4 feet x 8 feet and not less than .060 inches thick, are softened and welded into one continuous lining by a hot air torch to provide complete protection for the concrete pipe, which will be subjected to corrosive industrial and septic sewage. Consisting of 78-in., 48-in., and 39-in. pipe, the 35,000 lineal feet of reinforced concrete, used for the Orange County Joint Outfall Sewer, is lined with approximately 400,000 square feet of the plastic sheets. The pipe is being lined only three-quarters of the way around inasmuch as the gas-exposed area above the water is the only portion of the pipe which requires full protection.

● *LARGE sewer is lined with plastic sheeting ¾-way around.*

After milling the ingredients—Goodrich Geon polyvinyl chloride resin, inert pigments, and plasticizers—the final shape of the T-Lock Amer-Plate is formed by molding. Larger sheets and odd dimensions other than the standard 4 ft. x 8 ft. size can be provided to fit specific requirements for both pipe and structure lining.

When concrete is poured for pipe or structure, the tees, or ridges, on the back of the sheets are imbedded and locked into the concrete and thus forms an integral part of the end product. Being thermoplastic, the sheets are then fused together by a hot air torch to form a strong union between the joints.

Septic Sewage Problem

The problem of septic sewage, such as that encountered in the California pipe line, depends on several factors, all of which go together to create the corrosive conditions. Hydrogen sulphide gas is the material which, on oxidation, causes concrete disintegration. This gas is formed by bacterial action on both the sewage solids and the sulphates in the water supply.

Industrial sewage, such as fruit cannery, packing house, and fish cannery waste, can increase the hydrogen sulphide problem once it reaches the local mains by overloading with organic waste. Steel mills, chemical plants, plating plants, etc., can also cause a problem by increasing the acid content of the sewage, further affecting the concrete.

According to Amercoat Corporation, Geon vinyl was chosen as the principal ingredient of the sheeting because it is extremely tough, has a very high resistance to chemicals, is not appreciably affected by oxidation, has a low water absorption, and is not affected by oils and greases. It has the additional property of being thermoplastic so that under heat and pressure it is possible to form it into any desired shape.

In addition to pipe, the plastic lining is applicable to manholes, underground gauging chambers, distribution chambers, etc.; and it may also be used as a lining for concrete tanks which are subject to corrosive acids and alkalis.

EQUIPMENT APPLICATIONS IN OHIO MAINTENANCE

L. F. SCHAEUBLIN,
Assistant Director,
Ohio Department of Highways

OUR Department uses a number of cranes with the clam buckets and drag buckets for cleaning out ditches, etc.; however, the need for and usage of the back-hoe attachment is increasing where trenching is necessary for the laying of pipe and conductors. In the past few years, the necessity for pneumatic tools, such as busters, drills, and clay spades has increased, due to labor shortage. The clay spade is an important labor saver in shaping up excavations in bridge work, etc.

Gasoline engine powered chain saws are used by the Bridge Department in their operations as well as by the Landscape Department in tree maintenance and clearance. The Department has recently purchased some pneumatic powered saws to be used in close places and where it is necessary to carry the tool up the tree. This machine is much lighter than the gasoline powered saw and safer where greater portability is needed.

The Department has built a number of small berm dozers, mounted on mowing machine tractors, for dozing back the berms under and back of guard rails. The blade on this unit is only six inches high and is controlled by the vacuum lifting device used in conjunction with the mower when used as a mowing machine. This little machine has proved to be a time saver and quite valuable in berm maintenance.

Pyramid and Z guards, used in protecting freshly painted centerlines, are picked up by a machine built by the Department. This is towed behind a truck at a rate anywhere from 10 to 20 miles per hour. To our knowledge a similar machine is being built by one manufacturer at this time. This method is much faster and requires considerably less manpower than the old way of doing the job.

Centerlining Developments

Centerlining is done by the use of a large truck mounted unit, carrying several hundred gallons of paint, at a rate of ten to twelve miles per hour. One of these units will put down about twenty-five miles per day applying the white intermittent centerline and one or two yellow lines, with the glass beads, whichever is needed. Two smaller units mounted on tractors, carrying 120 gallons of paint and doing the same work as the larger machines, are being used this year in conjunction with three of the larger truck mounted units. The apparent advantage of the smaller units over the larger ones is that they can cross bridges that are not rated to carry the tonnage of the

● ***DUMP body for 2-ton trucks developed by Department distributes loading and facilitates dumping. Rear of body shown above.***

large ones. Due to the cost of the smaller units being about one-fifth of that of the larger machines, it would be possible to have a greater number at the same overall expenditure, scattered over the State where they could be used when needed, rather than waiting for a large machine which would be scheduled in that area later.

The Department has purchased in the past two years quite a number of small tandem driven power graders in the weight class of 8,000 lbs., and costing approximately $4,500 each. We have found these machines to be quite satisfactory, not only where application requires a small grader, but in mixing bituminous materials, cutting off high expansion joints, and particularly on all berm work.

New Dump Body

The Department has recently developed a new type of dump body which is being used on all two-ton trucks. The tailgate of this body is sloped forward at the top about 24° making it possible to get length enough at the bottom of the bed to dump into the regular aggregate spreader box without the use of aprons, which are costly and unsatisfactory for several reasons. The truck body design puts the load forward enough to give the proper load distribution on the truck chassis. It puts the right percentage of the weight on the front axle, making better steering control when ascending steep grades while loaded. The design also tends to distribute any overloading farther forward than the conventional type body. The problems that this body overcomes are not experienced on most of the larger trucks, which is the reason for using it mostly on the two-ton units.

In the northern section of the State, where we experience our heaviest snows, we have three of the large rotary type snow removal units. The rotary mechanism is powered by a large Diesel engine and is mounted on a 28,000-lb. truck. Also, in this northern section the large one-way snow plow, truck mounted, is used extensively. Most of our two-ton dump trucks throughout the State are equipped with the smaller one-way plows. The Department has a limited number of the large V-type snow plows mounted on 21,500-lb. tandem drive and 22,500-lb. all-wheel drive power graders. These units prove their worth in case of an extraordinary snow storm in our area.

In the use of abrasives for ice control the application is made in most cases with the small spinner attached to the rear of the truck. Where chemicals are used, the best applicator the Department has found is a small engine driven blower type of machine that is carried on the tail gate of the truck body. This machine proves to be a saver of materials as well as doing an excellent job of spreading with only one man needed to operate it. In some cases, no operator on the rear of the truck is used, depending on safety conditions.

In weed mowing, two rotary types of mowers mounted on the rear of Ford tractors were tried this season and they proved to be very satisfactory. The units cost only $345 each, and due to their construction the maintenance operating cost was almost nil.

The Department has for two seasons used two full-hydraulically driven sickle bar type, tractor mowers, which gave excellent service at a low maintenance cost in comparison to the mechanically driven machines. Results were such that the Department purchased thirty more of the hydraulically driven machines this season.

Testing Concrete Quality in a Thick Wall

The ultrasonic non-destructive method of test was used by the ROAD RESEARCH LABORATORY, HARMONDSWORTH, ENGLAND, to determine the compressive strength of concrete at selected positions in a wall and to discover to what extent the strength of the test cubes was representative of the strength of the concrete in the walls. Results are summarized in tabular form. The walls were constructed in lifts of varying depth and from concrete of varying quality. The main conclusions drawn are: (1) The concrete in the cubes was much stronger than the concrete in the walls at the same age. (2) Factors causing variation in the strength of the concrete, e.g. increased cement content, had similar effects on the strengths of the concrete in the cubes and that in the walls. (3) Placing in 9-in. lifts produced better concrete than placing in 24-in. lifts. The deeper lifts tended to give concrete of poorer quality with some porosity near to the top of the lift.—By R. Jones in Concrete Constr. Engrg., condensed in Road Abstracts.

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Bituminous Test Road to be Constructed in Idaho

Construction of a bituminous test road will take place at a location near Malad, Idaho, on U.S. 191 sometime in the near future. This test is designed to furnish data for asphalt pavements comparable to those developed for rigid type slabs in the recent Maryland Road Test. The project, at an estimated cost of $275,000, will be supported by ten Western states and the program will be administered by the Highway Research Board. Unlike the Maryland Road Test which was on an existing concrete pavement, this test will be on a section of new bituminous pavement. The design will call for varying depths of base and subbases, from 6 to 22 ins. The wearing surface will be from 2 to 4 inches thick.

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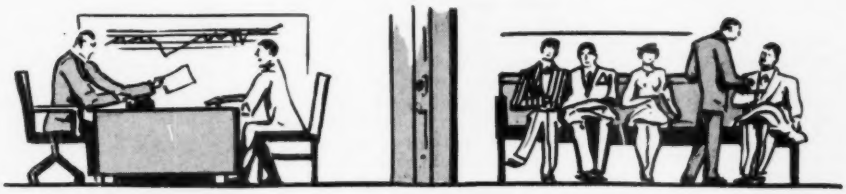
Utility Services Beyond City Limits

Richmond, Virginia, has adopted a comprehensive resolution defining water and sewer services to areas outside the city. Such services may be extended to the county or to any other public authority and to individual property owners when the city manager has determined it is practical to do so. Commercial and industrial extensions are approved by the council upon recommendation by the city manager. Extensions may be made only into areas which are within the limits of the metropolitan area as determined by the city planning commission. Outside service charges will be fixed by the council and service will be supplied on the contract terms and conditions which are outlined in the resolution. The cost of constructing city lines and the extension will be borne by the original applicant. The original applicant will be reimbursed from funds derived from allocable frontage line costs paid by subsequent customers. Each customer will pay a connection charge. The policy adopted by the council is based on a survey made by the city's bureau of the budget. The policy adopted is designed to encourage water and sewer extensions which will conform to city standards and which will return a substantial revenue.—Public Management.

INTRODUCING THE NEW WORKER TO HIS JOB



ERNEST W. FAIR

IN the past it often took the newer municipal employee as much as a year to orient himself to his job and the men who worked with him or for whom he worked. This was true whether he worked in refuse collection and disposal, street and highway engineering, water works, sewerage or any other part of the municipal operation.

Discoveries in employee management have lessened that time considerably, so that today the introduction of the new worker to his job can be accomplished in short order and with great success.

It is always best to have a plan of orientation worked out for the new employee and in the months ahead, when we will find it necessary to orient such new workers as quickly and efficiently as possible, such a program is even more of a must than ever before.

Such an introduction to his job should cover several important points, namely:

1) A welcome by a city official. By all means he should be welcomed to his job by the superintendent of the department under which he will work. If possible, the city manager or the mayor may find it well worth his time to seek out such new employees during the first weeks on their job and welcome them to the fold. Such a welcome given with sincerity and genuine purpose will establish a friend higher up for the new worker and the individual who does this welcoming should make it a policy to follow through in the first weeks on the job. This applies particularly to the department head.

2) The worker should be told about the department in which he will work, how it operates, what service it performs for the municipality, and how it fits into the operational scheme of the city management. If it has won national awards for efficiency he should know about these. He should also know about the record of achievement of the men under whom he is working. This can be done either personally or with a printed or mimeographed piece. Such procedure helps to instill pride in the department for which a man will work and in the job he has to do because the job is made more important to him than if he were thrust into it "cold."

3) He should be introduced to every possible department and city official, made acquainted with them accurately and not through some gossip grapevine of distortion, and shown they are all fellow human beings with a job of their own to do just as he has a job within the departmental organization as a whole.

4) He should be given a to-the-point description of the entire department in which he will work (what it does, its divisions and branches and how they operate as part of the whole, etc.) so that he may more speedily become acquainted with every phase of departmental operation and how his job ties in with the work of the whole department.

5) Timekeeping and payroll procedure, bonus schedules, wage rates, employee benefits, etc., should be explained in detail and it should be made certain that he understands these accurately to avoid future possible confusion and disappointment on his part.

6) Where any union affiliation is existent it should be made certain that he understands this fully.

7) All employee services that either the department itself or the city as a whole has available and offers its employees should be explained in detail as well as how he, as an individual, can use these to his personal benefit.

8) Safety and health rules should be given him, and his immediate supervisor should make it a point to supervise these and explain each in detail, making certain that the new employee understands them completely.

9) Proof of department official's interest in his personal welfare should be given the new employee constantly during his first few weeks of employment—the time when crucial impressions are made and developed . . . impressions that will ultimately establish his true value as a member of the departmental payroll.

Where it is possible to do so it is excellent procedure to offer all of this material in the form of an employees handbook which may be either printed or produced by a duplicating process. Such a handbook will pay dividends in giving the employee something he can take home and study and will also serve to establish all of the points of relationship between the department, as well as the municipality, and its employees so that misunderstandings at the start can be avoided.

Such a program of introduction of the new worker to his job should also include orientation on such points of policy as are concerned with promotions, transfers to other departments, layoffs, demotions, etc., all of which are of vital concern to any new employee.

The municipal department with a definite policy of promotion from within the department should make the most of this policy as part of any program of orientation of new

(*Continued on page* 88)

Colorado's Avalanche

J. M. ARMSTRONG

NOT many years ago snowslides in mountainous regions were considered as acts of providence, unpredictable and uncontrollable. Today the men and machines of the Colorado State Highway Department have conquered these great, white monsters that have threatened winter drivers with death, injury and indefinite delays.

Through scientific research, new inventions and unceasing efforts on the part of the National Ski Patrol, the U. S. Forest Service, the Army Corps of Engineers, and the U. S. Bureau of Reclamation, the Department has developed a program of avalanche control which assures mountain travelers the utmost possible protection against snowslide hazards.

Winter highway maintenance in Colorado has always been a difficult and sometimes apparently impossible task. Aside from being the seventh largest state in the nation, Colorado has seventy-five per cent of all the area in the United States which is more than ten thousand feet above sea level. For traffic to travel safely over 4,000 miles of federal-aid highways throughout the season, despite heavy snowfalls, windblown drifts and avalanches, seventeen mountain passes must be kept open.

Predicting Avalanches

The comparatively ordinary problem of clearing snowfalls and drifts was overcome long ago, but only recently has the State Highway Department become able to prevent the damage caused by sudden snowslides. After many experiments and the compilation of information from other states and Europe, the Department now knows under what conditions avalanches are formed and can predict within eight hours the time when a slide will begin its run.

The Department has found that snowslides on hillsides are formed usually by windblown particles which have changed from hexagonal-shaped snowflakes to tiny balls of ice while in the air. These particles are deposited by the wind just under the brow of a hill and grow together because of differences in temperature of the air, the ground, and the snowbank. Instead of remaining snow, with a moisture content of one inch to a foot, these particles have become a slab of ice, with a frozen moisture content of as much as fifty per cent.

Under certain conditions of wind and temperature, the slab of snow becomes anchored at the top, bottom and edges while its center is left unsupported. Gravity begins to pull at the bottom of the snowbank, stretching the slab at its unsupported portions near the top of the hill. Eventually the limit of its stretch is reached, and the slab splits like a gunshot, with cracks ripping across it at a speed of seventy to eighty miles an hour. The unsupported center mass now roars downhill, sweeping with it trees and boulders and covering acres of slope.

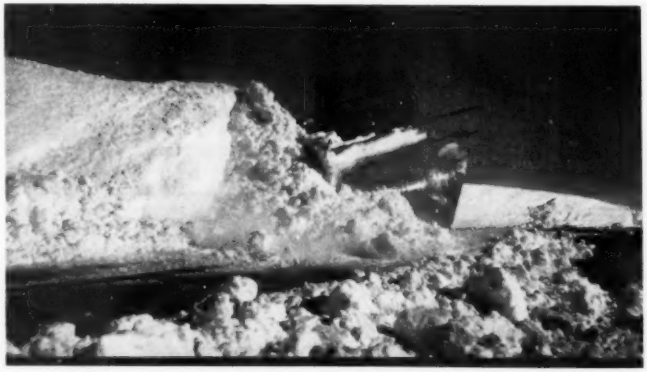
Checking Crucial Areas

When past experience or changing conditions indicate that an area is subject to avalanches, the Highway Department constantly checks the snowbanks at crucial points.

First, the newly-developed penetrometer, a device for measuring the resistance of snow, is used. This instrument is a long, aluminum alloy tube with a point which remains constant in size. It has a scale that is graduated into centimeters and a weight at the top which can be lifted and dropped on a rod. By placing the point of the instrument in the snow, raising the weight and dropping it, a measurement in foot-pounds of pressure exerted on the penetrometer and the resistance of the snow is obtained. From these measurements the formation of the snowbank is determined—whether it is solid, whether it contains ice, or whether it has an almost hollow center filled with loose snow.

Then samples of the various layers of snow in the bank are analyzed microscopically to find out

● ***THIS is a rear view of a rotary plow***



● ***V-TYPE plow cleaning up a controlled avalanche near Divide.***

CONTROL PROGRAM

working on the Continental Divide.

the moisture content, weight and shape of the snow crystals. Finally, the velocity of the wind, its direction, the amount of snowfall, the humidity and anticipated weather conditions are considered.

If the snowbank is found to be dangerous, the Department calls in a special committee made up of members of the National Ski Patrol, the U. S. Bureau of Reclamation, the U. S. Forest Service, and the Corps of Engineers, all under the supervision of Douglas N. Stewart, Maintenance Engineer of the State Highway Department. Messages are sent to highway crews to halt traffic on either side of the crucial area, and radio-equipped trucks are posted as an added measure to prevent driving on the highway beneath the slide.

Field Procedures

Members of the committee drive to the location of the snowslide. Here they put on skin-covered skis, rope themselves together, and, carrying dynamite on packs, climb to the top of the avalanche area. If conditions are particularly critical, the mere movement of these men on skis can cause a slide, and even the sound of an automobile horn has brought down avalanches.

Ordinarily, the skiers get as close as possible to the taut stretch at the top of the snowbank, tie several sticks of dynamite together, attach a fuse, light it, and throw the bundle of explosives. When the dynamite explodes, a geyser of snow is thrown into the air, the snowbank trembles and then crashes down toward the road.

Sometimes a slide spreads out along the hillside and settles before reaching the highway. At other times, slides have smashed onto the road covering it to a depth of twelve feet for dozens of yards and plunged on down the mountainside, despite the block of six-foot snowbanks along the shoulder.

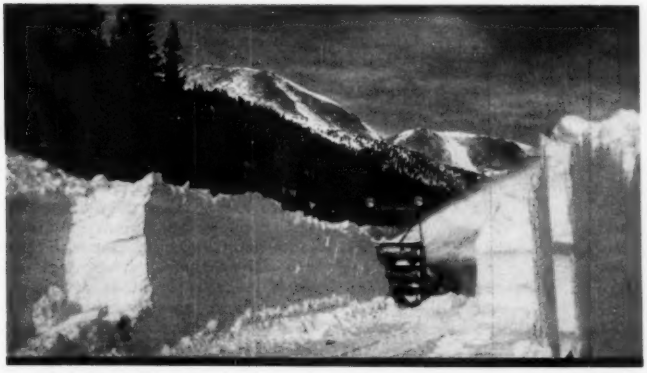
Rotary snowplows and blade plows which have been waiting now attack the snow, and in as little as forty-five minutes, the road is clear and ready for traffic to resume.

The annual cost of Colorado's winter highway maintenance, including snowslide control, is about $500,000, as compared with $50,000 in 1929 when the state first kept open three of its mountain passes.

In addition to the penetrometer and other special equipment, highway employees use thirty-seven rotary snowplows and wideners and over two hundred trucks equipped with plows, thirty-three of which are heavy "V" type. Short-wave radio sets are installed in much of the equipment used in mountain areas.

Two hundred of the Highway Department's seven hundred employees are stationed on the mountain passes. Often work for these men may continue as long as seventy-two hours without rest. All in the day's work, they pull innumerable vehicles out of ditches, rescue snowbound motorists, and keep the highways clear. In addition to fighting snow and ice, as well as long hours, these employees must face the added strain presented by the high altitude at which they work.

Even so, the Colorado State Highway Department has been one hundred per cent successful in its new snowslide control program, and has eliminated one of the most treacherous enemies of winter motorists in the state.



● *ROTARY plow clears controlled avalanche from highway.*

● *CLOSE-up of rotary at work.*

DUAL PLANT

RUTH TEISER and CATHERINE HARROUN

● ***CHECKING the temperature of the sludge passing through the heat exchanger: Harvey J. Milts, Sup't. of Sewage Treatment.***

FOUR years ago, the voters of San Leandro, Calif., approved a bond issue of $900,000 for rebuilding and enlarging the city's sewage treatment plant. At that time, it was pointed out that $2,000,000 in industrial development was pending which would require additional facilities for waste treatment. Construction was virtually completed by the end of 1948 and San Leandro became the first California city to provide for separate treatment of sewage and industrial waste. Development and growth since that time have tested and proved the soundness of the planning.

Local Conditions

With a population of 27,000, San Leandro is situated on the eastern shore of San Francisco Bay and is served by two major railroads. Good industrial sites are available, taxes have been kept low, and the city has been enterprising in the matter of bringing its advantages to the attention of industry. As a result, by mid-1951, industrial development was nearing a total of $40,000,000, as compared to the $2,000,000 under consideration in 1947. Community leaders believe that a major factor in this remarkable growth has been the satisfactory solution of the problem of industrial waste disposal.

Soon after the plant was completed, the chairman of the State Legislature's Committee on air and water pollution called it the most satisfactory plant in the state and the first fully to meet and maintain State Department of Health standards governing effluents discharged into San Francisco Bay.

Design Data

The plant was designed by the engineering office of Clyde C. Kennedy of San Francisco. It provides separate treatment for domestic sewage and industrial wastes; or the two may be mixed and the industrial waste given the same degree of treatment as the domestic sewage. The plant capacity is 3 mgd of domestic sewage and 4 mgd of industrial waste. Without major change, the plant can be expanded to handle 12 mgd. Principal plant units, in addition to the pumping installation, include: An industrial primary sedimentation tank equipped with pre-aeration facilities; primary sedimentation for the domestic waste; a high-rate filter equipped for recirculation; secondary sedimentation; three 60-ft. PFT-equipped digesters; and twelve 60-ft. by 60-ft. open sludge drying beds.

Domestic sewage and industrial waste may be kept separate throughout the process of treatment, or may be mixed when and as advisable. Ordinarily, industrial waste is given only primary treatment before discharge into the Bay.

As it arrives at the plant, domestic sewage is passed through a Chicago comminutor, while industrial waste is screened. Both go next into wet wells located on either side of the pump house. The main pumping station is equipped with eight 1.3 mgd Fairbanks, Morse centrifugal pumps. From the wet wells, the sewage is pumped into separate grit channels, Link-Belt equipped, which are adjacent to the industrial primary settling tank. About 100 pounds of chlorine are added daily at the end of the grit channels to prevent odor. In addition, a local Purex plant dumps a combination of chlorine and caustic soda regularly, aiding in solving the plant's odor control problem.

Domestic sewage flows next to the domestic sewage primary sedimentation tank, and the industrial waste to the industrial waste primary sedimentation tank. It is at this point that the wastes may be mixed in any proportion deemed advisable.

After primary treatment, industrial wastes may be discharged to the Bay or they may be pumped

to the secondary treatment facilities; all domestic sewage is given secondary treatment. This consists of a high rate filter, 105 ft. in diameter and 4 ft. deep. The media is of 3-in. to 4-in. size. Design loading on the trickling filter is 2 pounds per cu. yd. of media. Recirulation ratio at the 3 mgd operating rate is 1.4 to 1. From the trickling filter, the sewage flows by gravity to a final settling tank and thence to the Bay through an 84-inch reinforced concrete combined sewer.

is $37,280 per year, which includes all salaries, power costs and maintenance. This amounts to about one-half cent per person per day.

When the plant was started, development of a suitable growth on the filter was delayed. It was noted that, several times a week, a reddish orange tint could be seen in the sewage. This was traced to the discharge from an industrial plant of a red aniline dye. When this was discontinued, the filter developed quickly, with no more trouble.

With the introduction of a considerable amount of industrial sludge during the canning season, starting with apricots, trouble was anticipated. About two weeks after the apricot waste started coming to the plant, a mild foaming started. This was remedied by pumping digested sludge from the old primary digester back into the new primary digester. This procedure cured the trouble. No lime or other alkali was added. Recirculation proved sufficient.

TREATS SEWAGE AND INDUSTRIAL WASTES

Operation Data

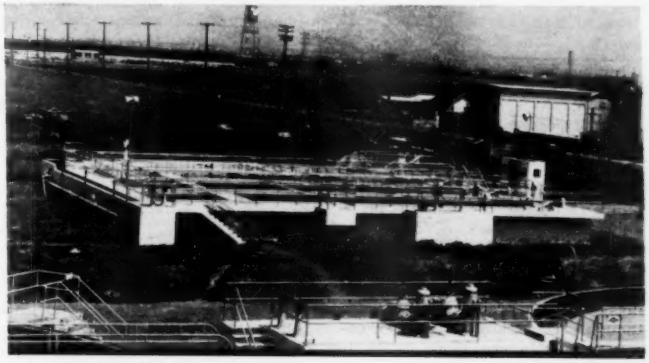
The industrial waste varies markedly from time to time, with suspended solids ranging from 575 ppm to 90 ppm in the raw, and from 225 ppm to 60 ppm in the primary effluent. The 5-day BOD ranges from 1210 to 185 for the raw and from 480 to 97 for the primary effluent. During the peach and tomato canning season, the domestic and industrial wastes were mixed in the primary industrial tank and the entire flow of both was passed through the filter. Average overall removal of SS and BOD averaged 86%. Industrial waste pH varies from 5.3 to 9.0. Volume of flow ranges up to 1.1 mgd, average.

The flow of domestic sewage averaged, in the past fiscal year, 1.7 mgd. Suspended solids in the raw domestic sewage averaged 307 ppm; in the primary effluent 209 ppm; in the trickling filter effluent 145 ppm; and in the final effluent 57 ppm. Raw BOD averaged 345 ppm; primary effluent 238; trickling filter effluent 98 and final effluent 68 ppm.

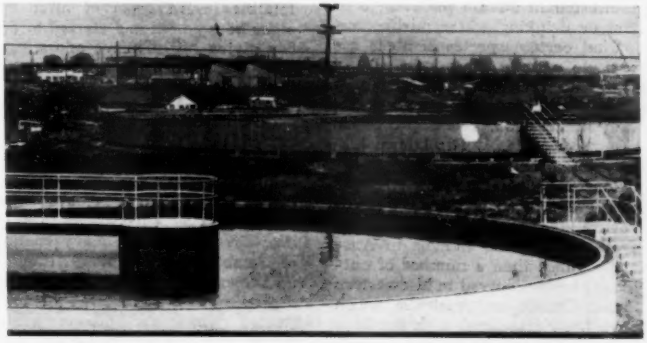
Operating Cost

The digested sludge is drawn to the open beds, usually to a depth of 17 ins. In 30 days of drying, the depth is reduced to about 3½ ins. When dry, the sludge is removed from the beds, ground and pulverized and sold for lawn, garden and soil conditioner. The price is $20 per ton and some profit has been derived from the sale.

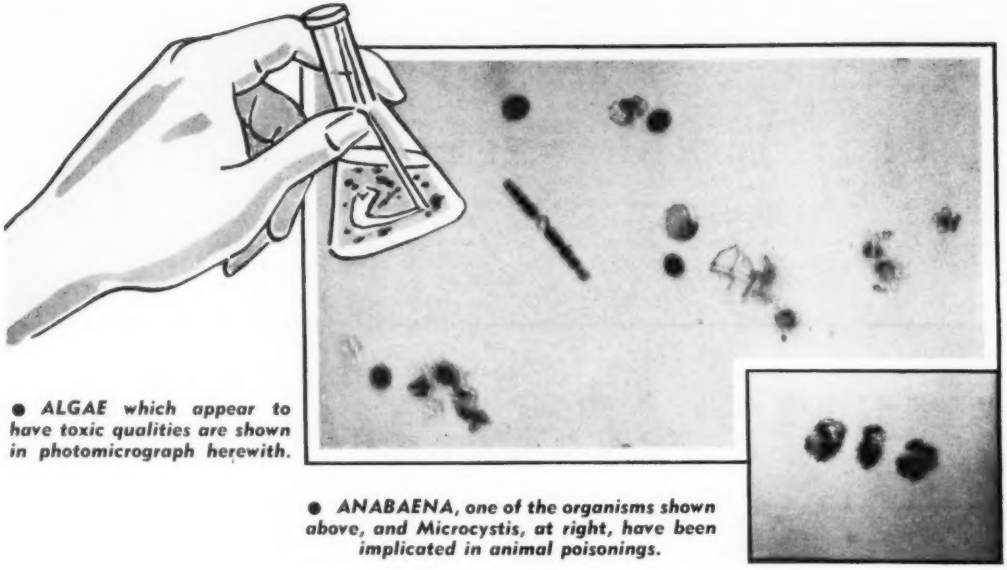
The operating budget of the plant



● ***PRIMARY** industrial sedimentation tank. In foreground, left to right, are secondary tank, booster pump and domestic primary tank.*



● ***TRICKLING** filter in background, with secondary settling tank in foreground. Filter loading is 2 lbs. per cu. yd. of stone.*



● ***ALGAE which appear to have toxic qualities are shown in photomicrograph herewith.***

● ***ANABAENA, one of the organisms shown above, and Microcystis, at right, have been implicated in animal poisonings.***

Algal Toxins

ROBERT M. SCOTT,

Bacteriologist, Illinois Dep't. of Health

POISONING of man and animals by algae, has provoked little public interest, the reason probably being the lack of direct incriminating evidence connecting them with public health problems. Veterinarians have had more dealings with this problem than others, though often unknown to them, because animals are more likely to drink algae-infested waters than humans. However the possibilities of illness and fatalities to livestock and humans by waterborne toxins should be recognized by all persons interested in stream pollution control or drinking water purification.

That certain species of algae are toxic to animals in at least part of their life cycle, or as a result of certain conditions of growth not yet fully understood, seems proven in a number of cases. The known history of probable algae poisoning dates back as far as 1878 when a blue green algae nodularia was reported as the possible cause of death to domestic animals in Australia. Since then a number of outbreaks have occurred in Midwestern States, Canada and Australia, which have been associated with the blue green algae, Anabaena and Microcystis. It should be understood that in these outbreaks no other causative agent could be found and since algae were ingested they were blamed. In most cases there was a wind blowing shoreward and a thick scum or "bloom" had collected on the water so that the animals had to ingest the algae as they drank. In these outbreaks no fatalities were reported after the algae became old and started to decay giving off offensive odors.

Other Incidents

An outbreak of toxic algae occurred in Wild County, Colorado, in July 1939, in which a number of fish, salamanders, snakes, four ducks and a calf died ostensibly after drinking the water from a lake covered with a heavy coating of Anabaena Flosaquae. Although no known toxin was segregated, the presence of a toxin was demonstrated when the filtrate killed guinea pigs in seven to ten minutes. Refrigerated algae 21 days old, which were boiled thirty minutes, were fatal to guinea pigs in twenty to thirty minutes when given intraperitoneally, although no effects were noticed when given by mouth. Foaming at eyes and partial paralysis were observed. Investigators concluded that the toxin of this algae was very potent, and that it was the causative agent of the death of animals which drank it. It was further believed that the algae lost its toxicity after it began to decompose. In another report the same observers state that experimental animals were killed by feeding 20 ml. of the algae, and that 2 to 5 ml. of the toxin given intraperitoneally would kill in 5 to 38 minutes.

Wheeler and Lackey of the U.S. P.H.S, studied the toxicity of microcystis while on a field trip in Kentucky. They found that freshly collected specimens were somewhat toxic for mice and guinea pigs when given intraperitoneally but not by mouth. Frozen algae and dried algae were found to be more toxic than freshly collected specimens. They withstood water purification treatment consisting of alum coagulation, filtration and chlorination as far as laboratory methods could imitate them. These workers gave algae suspensions and filtrate

by mouth, intraperitoneally and subcutaneously and later repeated the work using boiled algae, with similar results. They did post mortems on all deaths, but could demonstrate no known poison. At any rate they found the material toxic and noted the same symptoms of foamy eyes and agony. It should be remembered that these workers were taking the algae where they could find them and not after they had caused an outbreak of deaths.

North Dakota Outbreak

During the summer of 1946, Dr. F. M. Shigley of the U. S. Bureau of Animal Industry, cooperated with Dr. T. O. Brandenburg, State Veterinarian of North Dakota, in an investigation of cattle poisoning near Upper Des Lacs Lake in North Dakota. The area had been drier than usual and the prevailing winds, blowing from one direction for three or four days at a time, had caused the very abundant algae to become diffused through the water so that the animals were forced to drink large quantities of the algae. Birds injected intraperitoneally or drenched with suspensions of the algae after a few minutes showed symptoms of restlessness, blinking of the eyes and repeated swallowing with upward jerking of the head. There was frequent defecation and death followed seizures of colonic spasms.

Cattle symptoms were much the same as reported by previous investigators: stupor and unconsciousness, falling and remaining quiet as if asleep, unless disturbed, when convulsions developed, and subsided before death. A few animals which recovered showed symptoms of scaly skin and many raw patches were present on the nose, lips, udder and white-skin areas of the body. No losses occurred in animals after removing them from the lake area.

The field report by T. A. Olson of the University of Minnesota was: "Round Lake is situated in the northern half of Minnesota. It is a small, shallow body of water indirectly receiving the sewage effluent of a small municipality. Because it is shallow and well fertilized, green algal blooms have frequently been seen, and residents claim that it was intensely green and malodorous years ago when hundreds of ducks died along its shores. In late May, 1948, the lake again assumed its brilliant green hue and heavy algae scums were seen along the edges. On the 27th, a valuable yearling stallion having access to a sheltered portion of the shoreline where the scum was particularly heavy died suddenly. Early Sunday morning, three days later, a pair of two year olds and two additional yearlings were found dead. A fruitless search was made for toxic forage plants and a post mortem examination was made by the local veterinarian without positive results. On the same day two dogs were seen drinking lake water at 4:00 P.M. By 6:00 P.M. one was dead, the other exceedingly ill. The latter survived after a long convalescence. Its recovery was locally attributed to the beneficial effect of the large quantities of fresh milk which had been administered to the animal shortly after it had been seen lapping the lake water. A pheasant, a great blue heron, and a snipe were also found dead along the shore were algae had been concentrated. A sample of water collected on the day following, May 31, when the algae had been largely dispersed, contained only a moderate amount of algae but was toxic to mice when tested in the laboratory. Symptoms produced in the laboratory animals were identical with those seen in typical cases of algae poisoning. The algae in the sample was *Polycystis aeruginosa* (Microcystis)".

A number of other authentic instances of algae poisoning have been investigated by Olson and his staff in the past four years.

Based upon the above reports and those of other investigators it can hardly be doubted that some of the blue-green algae under certain conditions of weather, season, rainfall or other unknown stimulant, do at times excrete a potent toxin capable of killing animals in a short time. Death comes too rapidly for the veterinarian to have a chance to treat. The onslaughts are so violent, so virulent and unpredictable and pass so quickly that people are never prepared for them. Then too the outbreaks appear so irregularly, and so many have probably not been reported, due to the mystery surrounding death, that they have not forced themselves into the attention of the public as if they were a human health problem. No cases of human poisoning by algae have been reported in the literature, but these algae poisons may be just as potent to humans as to animals. (However, humans will not drink of water covered with a foul smelling algae and consequently have not been subjected to the same poisons as animals have.)

Nature of the Poison

Early laboratory work by C. P. Fitch, indicated that the poisoning was in the nature of a true toxin existing both in the organisms and the surrounding water. It was most potent when algae are young and fresh, was not volatile and heat stable in dried material and retained its potency when air dried. The symptoms noted were convulsion and prostration followed by death after intervals varying from a few hours to a day. Olson at the University of Minnesota, in his

(*Continued on page* 65)

$ VILLAGE PROFITS $ FROM MUNICIPAL POWER

FAYETTE WEAVER,
Power Plant Superintendent,
Shelbina, Mo.

MUNICIPAL electric power has a 56-year history in Shelbina, Mo., a town of 2000 inhabitants which is located about 100 miles northwest of St. Louis. Shelbina, whose industries center around farm produce, particularly poultry, eggs, and feed, has gone through five phases in its power production. The latest phase, into which it recently was fully converted, followed modernization of diesel-electric power service with three more powerful, full diesel engines replacing the original two small semi-diesels and one full diesel unit.

Three Baldwin diesel engines now in service provide a total capacity of 1980 h.p. or 1320 kw. Two 750-hp. engines are used alternately every other week and carry the base load. A 480-hp. unit is used together with one of the 750-hp. units for the peak loads. This schedule provides for an adequate maintenance program and assures unfailing power in the event of an emergency shut down.

This power plant supplies the community and surrounding country with power and light requirements, as well as the industries in the community. All current for lighting the streets of Shelbina, the library, and all city offices is furnished without charge. This amounted to 300,000 kwh. during 1949. The Light and Water Department transfers to the general fund of the municipality from $18,000 to $20,000 each year.

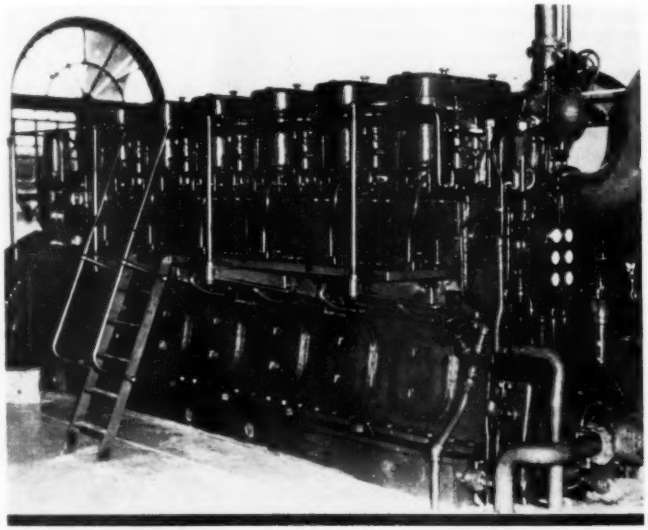
Total kilowatt-hours generated during 1949, approaching 2,500,000 kwh., showed 100% increase in 10 years and 400% increase since 1932. Street lighting, which required 20 to 25% of the power generated during the early 1930's, now takes twice as many kilowatt-hours but was only 1/8 of the total generated in 1949.

After the installation of the first two Baldwin units, the cost per kilowatt-hour was progressively reduced from 1.90 cents per kwh, to 1.23 cents per kwh., until 1944 when subsequent increases in costs were brought about by the rising cost of fuel and lubricants and general postwar inflation. This brought the cost up to 2 cents per kwh. Upon installation of the latest engine, cost reductions were again effected and the present cost per kwh. is 1.84 cents. It should be noted that the average load is only 275 kw., about half the full load rating of the 750-hp. engine. During peak periods the engine operates at its full load rating.

Engine accessories include an enclosed water cooling system with an Ames forced draft cooling tower with coils of 2400 hp. capacity and space for additional coils of 1000 hp. All engines are interconnected to this system so that a pump with a capacity of 400 gallons per minute furnishes cooling water to all engines or to one as needed. Cooling water is softened by Zeolite and is further treated with Chromite. Compressed air is used for starting all engines.

Each engine is equipped with a set of lubricating oil strainers and the oil is kept in good condition by a Hilco oil reclaimer of the Fuller earth batch type. The reclaimer is used continuously for 48 hours per week, taking the oil from the engines, through the reclaimer, and back to the engine. The oil thus gives maximum service. Manifolding permits the use of the reclaimer on any one of the engines. Conventional protective devices are used on each engine: low pressure alarm and shut down for lubricating oil, high temperature alarm and shut down, and over-speed stop.

The men responsible for giving the City of Shelbina this all-diesel installation are: Mayor P. A. Adams and Alderman R. G. Clapper, Guymon Hatcher, Carl Miles, and J. R. Shultz.



● ***MOST recent addition to the Shelbina municipal power plant is this Baldwin diesel, which is a 6-cylinder engine, 750 hp at 300 rpm. It drives a 500-kw Westinghouse generator.***

● *CITY has three 12-yd. Load-Packers.*

● *DELIVERING garbage to the Contractor.*

FREE TRASH AND GARBAGE DISPOSAL

PAUL W. TRAVIS

EVERY house and business in Santa Ana, California, is given free trash-and-garbage removal—paid for out of city taxes. After thirty years of free collection—how is it working out?

The approximately 14,500 stores and houses are served by a collecting crew of 38 men. Uptown there are daily pickups for both trash and garbage, while in the residential section service is once a week for trash, and twice a week for garbage.

Five Gar Wood Load-Packers and ten open trucks of various makes, are used. There are G M C's, Chevrolets and Internationals among the open trucks, and every one is equipped with dumping hoists.

Garbage Collection

Two Load-Packers haul the garbage on the day shift. Each is manned by a three-man crew. One is held in reserve. One open-truck works an eight hour shift at night, up town. The two Packers hauling garbage on the day shift each make two trips to the hog-feeding contractor's trailer a day.

The garbage is sold to the garbage contractor at a sliding price, based on hog-prices, and presently at $2.52 a ton, yielding about $10,000 yearly. The city delivers the garbage to the contractor's trailers, 4½ miles from town, near the city dump.

To find the number of business-and-residential units collected by the collecting units, I found that there were sixteen eight-hour shifts worked by the garbage collecting units each week in collecting twice over the town. This means that each unit serviced 1900 customers each shift. A qualifying factor here, however, is that sometimes up to 40% of the customers will not set out garbage.

A steel wagon bed open truck is used uptown at night because the restaurant garbage contains so much moisture that it is almost a liquid.

The monthly volume of garbage during 1951 was typical: from the customary February low of 271 tons, to 350 for June, to the yearly high of 452 tons in July, 449 in August, and 376 in September.

Trash Collection

Trash is collected with two Load-Packers and ten open trucks. While collecting, each truck is manned by two loaders and the driver. But the loaders never go to the dump, for the trucks are scheduled so that when one truck is loaded, the loaders go on to another.

The trash trucks each make the 4½-mile run to the city dump four times a day. Two trash trucks work an eight-hour night shift. These carry three men each.

The trash is sold, delivered to the dump, to a contractor who pays $105 every three months for it, and also agrees to run, man, and mechanize the dump out of his own pocket. He gets the trash and agrees to burn and dispose of the refuse.

The trash loader's chief complaint is that too many people's trashcans exceed the 75-lb. limit. They complain also that vacuum cleaner dust is often not securely packaged.

The City Dump

The equipment at the dump consists of two Allis-Chalmers gas-engined bull-dozers, and one diesel Caterpillar dozer. There are six open trucks; a homemade press-and-baler for rags and paper; and two Case hay balers, one 21-inch and one 28-inch, to bale cardboard and lightweight paper. There is a tree-sprayer outfit, on a truck, to extinguish fires and to wet down cardboard. In all, seven men are employed by the dump-contractor, Jack Arutian.

Incoming trash is distributed over the 17-acre dump this way: trees and brush are piled together and burned. Bricks and stones are placed in one pile. The paper is piled near the balers. The old shoes, clothing and similar things of value are watched for, but the Salvation Army and Goodwill Industries are very active here.

The contractor has been getting up to $24 a ton for cardboard, but the price has lately dropped to $18. He now gets $11 for lightweight paper, one cent a pound for rags, and lets the tin cans go for the carting away. Every thing he sells he must deliver in Los Angeles, thirty five miles away.

He says he has to handle altogether about seventy incoming loads a day, including those brought in by private citizens. He carries li-

● ***CARDBOARD in 2000-lb. bales—one of the salvaged items.***

ability insurance to cover every one coming on to his dump.

Since there are no laws in Santa Ana against it, unauthorized trucks precede the city trucks along the collection routes, picking out the valuables—and irritating Mr. Arutian, as one can understand.

As in every dump, rats and flies are a problem. The city makes a contract with an exterminator company, to poison the rats and spray against the flies. The county health department is urging stricter control and justifiably so, for the flies are too numerous.

However, much of the "fly problem" arises from the open trailer which the garbage contractor leaves entirely uncovered in the vicinity of the dump.

The city pays for everything up to delivery to the dump and garbage contractors. The cost totals $153,000 a year, or about $1 per month for each unit serviced. To get the money there is an assessment of 30¢ per $100 against real property.

And how is this city-financed garbage collection working out?

The chief complaint is that the cost is distributed inequitably, that the $50,000 property owner pays six times more than the man with $8,000 in property, yet may not have as much garbage.

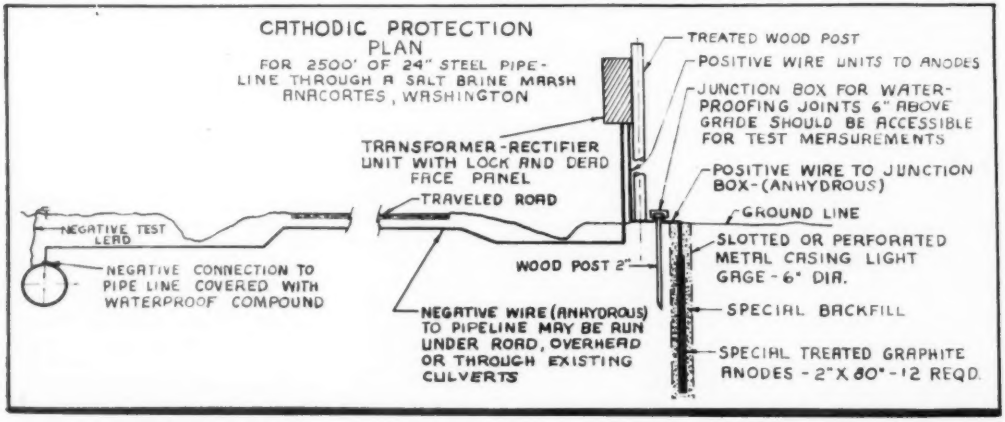
Another complaint is that the front-curb collecting of the city makes for an unsightly street just before the collectors pass. But curb-collecting saves the city money, and it is hard to see how it could be done otherwise, since there are few alleys in Santa Ana.

Corrosion Control for Pipe in Salt Marsh

The installation of a specially engineered cathodic protection system for the city of Anacortes, Washington, has substantially reduced leakage in a 2500-foot line of 24-inch steel pipe. Because this pipeline is laid in a salt marsh, as many as 30 to 40 leaks per year occurred prior to the installation of a cathodic protection system. In the two-year period that the pipe has been protected by the Harco system, there has been a total of only 3 pinhole leaks. This reduction of more than 96 per cent has been effected in spite of the fact that the pipe is exposed to extremely corrosive conditions.

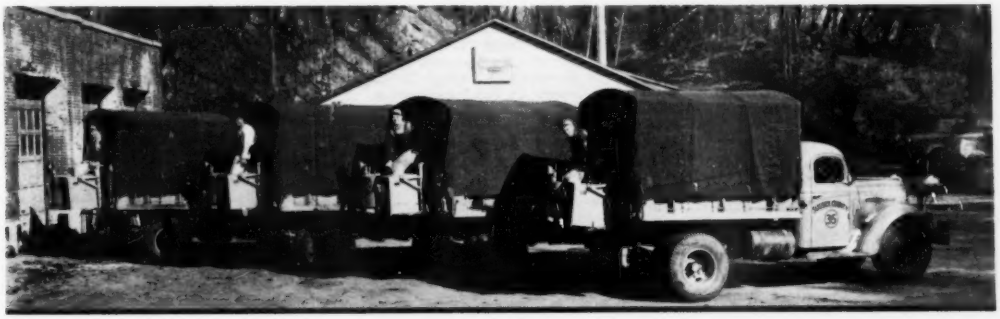
In this installation, specially treated graphite ground anodes surrounded with backfill material are buried approximately 200 feet apart with junction boxes extending 6 inches above grade. One transformer-rectifier unit with lock and dead face panel is located approximately at the center of the installation. From this a positive wire runs to the buried anodes and a negative wire extends 40 feet under the road to the pipe-line on the opposite side.

In operation, direct current from the transformer-rectifier unit is impressed upon the anodes and radiates through the soil, which acts as the electrolyte, to the metal pipe. The current enters the metal surfaces of the pipe and opposes the electro-chemical corrosion.


CATHODIC PROTECTION
PLAN
FOR 2500' OF 24" STEEL PIPE-LINE THROUGH A SALT BRINE MARSH ANACORTES, WASHINGTON
TREATED WOOD POST
POSITIVE WIRE UNITS TO ANODES
JUNCTION BOX FOR WATER-PROOFING JOINTS 6" ABOVE GRADE SHOULD BE ACCESSIBLE FOR TEST MEASUREMENTS
TRANSFORMER-RECTIFIER UNIT WITH LOCK AND DEAD FACE PANEL
POSITIVE WIRE TO JUNCTION BOX-(ANHYDROUS)
TRAVELED ROAD
GROUND LINE
NEGATIVE TEST LEAD
SLOTTED OR PERFORATED METAL CASING LIGHT GAGE - 6" DIA.
NEGATIVE CONNECTION TO PIPE LINE COVERED WITH WATERPROOF COMPOUND
WOOD POST 2"
NEGATIVE WIRE (ANHYDROUS) TO PIPELINE MAY BE RUN UNDER ROAD, OVERHEAD OR THROUGH EXISTING CULVERTS
SPECIAL BACKFILL
SPECIAL TREATED GRAPHITE ANODES - 2"X 60" - 12 REQD.

● ***DETAILS of cathodic protection installation for a steel pipe line laid in a salt marsh.***

FAST and LOW COST SNOW REMOVAL



● ***SUSSEX County's trucks are equipped with Tarco spreaders.***

LEON C. McKEON,
Road Supervisor,
Sussex County, New Jersey

USE of coarse rock salt for snow and ice removal in Sussex County enables us to save money during the winter. At the same time, skidding accidents are reduced and better service is provided on the 300 miles of road on which we carry out winter maintenance operations.

Although the money-saving aspect of our program is naturally important, I have always felt that providing improved service to the public—including increased safety—is even more important. People now expect more in terms of winter highway maintenance. Since they pay for it, the public is entitled to the best safety techniques and services that can be provided.

With that in mind, five years ago we began using coarse rock salt to speed snow removal operations and to provide safer highways free of ice and snow. At first rock salt was mixed with abrasives. We gradually discovered that clear rock salt applied alone does a better, faster safety job than the abrasive-salt mixture. In addition clear rock salt is more economical.

By applying straight rock salt we safeguard our highways much faster, because a truck load of salt covers over five times as much road surface as a load of abrasives. As a result our salt trucks do not return to reloading stations so often. Besides valuable time, considerable money is saved that used to be spent for gasoline, oil, and equipment use consumed by extra return trips.

When abrasives were used we were really putting dirt and rubble on our highways. Naturally most of this had to be removed later at considerable expense. By using straight rock salt we have eliminated that extra clean-up work.

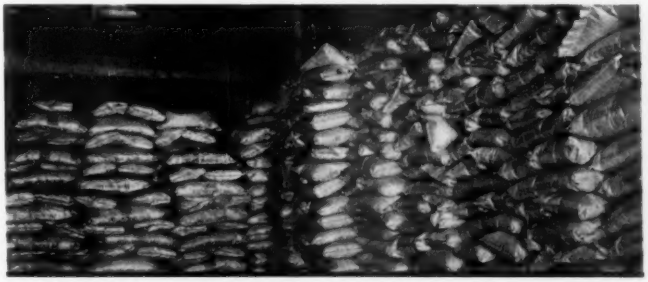
Actual snow removal time has been greatly reduced. We have found that the clear rock salt treatment removes snow falls up to a two-inch depth without plowing. When we have heavier falls salt keeps the snow from freezing and bonding to the pavement. And when our plows go out they are able to plow roads fast and clean.

Timing is important in fighting a snow or an ice storm. We save considerable time by starting our salting operations as soon as a storm begins. We watch weather reports closely. When we know that a storm is headed our way our foremen are alerted and removal operations begin.

Throughout the county we have 12 different stations with a man on duty at each at all times. Early in the fall we store rock salt at each station and we try to maintain an ample reserve during the winter. Our salt spreading equipment consists of nine Tarco "Scotchman" salt spreaders. During bad storms we salt our roads once every 12 hours.

Sussex is the most northern county in New Jersey. The temperature ranges from 8 to 10 degrees lower here than elsewhere in the state. Because we control our ice and snow storms with clear salt we feel sure other counties could do the same. In fact our successful use of straight rock salt has been observed and followed by several other communities.

In brief, that's our Sussex County story of ice and snow control. The 75 men in the department have cooperated fully in developing this program. The Board of Freeholders: R. A. Ayers, Lester N. Price, and Denton J. Quick, and George Harper, County Engineer, have supported and contributed greatly to its success. Because this clear salt method enables us to give fast, safe and efficient service, the public has expressed their appreciation for our new method of winter maintenance.



● ***STORED rock salt—nothing like a supply when you need it.***

Street Improvement Specifications for Subdivisions

The following specifications for subdivision street improvements were sent us by M. A. Nicholas, Chief Deputy, San Bernardino County, Calif., with the comment that "we feel we are going to benefit by less maintenance on new subdivision roads. They have caused trouble in the past." In these, the owner's engineer is required to prepare all plans, profiles and structural designs and to file these with and obtain the approval of the County Surveyor. The owner's engineer is then required to furnish the contractor with all of the engineering services necessary to accomplish the work.

WHEN the contractor and/or owner elects to perform the road grading and surfacing of a subdivision, the County Highway Department shall be notified. Tests of the native soil will be made by the Department, which tests shall include sieve analysis, stabilometer and others necessary to determine the condition of the subgrade, the required thickness of road-mixed material and the amount of asphalt necessary to insure a proper subgrade and surface. A fee, as estimated by the Department, sufficient to cover the actual cost of tests shall be deposited with the county. Reports from approved commercial laboratories will be accepted in lieu of the above.

Road-mix surfacing shall consist of mineral aggregate and liquid asphalt, mixed and spread on the roadbed to required width and thickness, and compacted and finished in conformity with the following specifications.

Subgrade Requirements

The subgrade, including the shoulder areas, shall be graded and shaped to conform to the typical sections shown on the approved plans and profiles. The owner's engineer shall set all necessary grade stakes for the grading of the roadway and the placing of drainage structures and shall supervise construction of the same. Crown and shoulder slopes may be modified to accommodate superelevation on curves and, in special cases, drainage.

All large rocks, roots and soft and unstable spots shall be removed and replaced with approved material. In areas where unstable soil conditions exist, and where road failures have resulted or may result from such conditions, the contractor will be required to excavate below fine grade (the pavement base grade) to a depth required by the County Engineer, and to import sufficient gravel or other approved material to replace the removed material to the original base grade and to the full width of the area to be paved. All material removed shall be disposed of as required by the Engineer.

The imported stabilizing base material shall be thoroughly rolled with a sheepsfoot or grid roller of approved type weighing not less than 10 tons until a relative compaction of at least 90% is obtained or until further compaction is not practical in the opinion of the County Engineer. In cases where imported material is used to stabilize the subgrade, aggregate for paving must be imported, and this shall be kept separate and apart from the stabilizing material, and shall not be mixed with it.

The finished subgrade may vary not to exceed one-tenth of a foot above or below the approved elevation of the subgrade, and it must be uniform and free from sharp breaks. Subgrade that does not conform to this requirement shall be graded and thoroughly rolled.

One day (24 hours) before completion of the prepared subgrade, and before spreading of aggregate or applying of asphalt, the County Highway Department shall be notified in order that inspection for acceptance of prepared subgrade may be made. Inspection will be made as soon as possible after notification.

Aggregate and Asphalt

The mineral aggregate may be native or imported, or a mixture of the two, in such proportion as specified by the County Engineer. The grading of the aggregate shall conform generally to the following: Passing square openings, 1-inch, 100%; ¾-inch, 95-100%; ⅜-inch, 65-85%; No. 4, 50-65%; No. 16, 30-43%; No. 50, 16-25%; and No. 200, 3-8%. The aggregate shall be sound and free from clay, adobe, trash or vegetable matter. Spreading of mineral aggregate shall be as follows: It shall be bladed into windrows along both shoulders of the roadbed. The windrows shall be of uniform size and of such quantity as to cover the required width of area to be paved to an uncompacted depth, when spread, of not less than 1½ times the required minimum finished thickness.

The grade of liquid asphalt to be used will be governed by the quality of the aggregate, weather and other conditions. The quality of the asphalt shall comply with the specifications of the AASHO and of the County Highway Department. Ordinarily grades of low viscosity of the slow or medium curing types (minimum SC-4) shall be used.

If distributors are used for asphalt application, the aggregate from one windrow shall be spread over one-half of the roadbed and the asphalt distributed thereon, under pressure, and in required quantity. The aggregate and asphalt shall then be mixed by means of any approved type of equipment until the mixture is of proper texture and color. It shall then again be windrowed and the remaining windrow treated in like manner.

Any approved type of traveling mixer may be used and the asphalt mixed directly with the windrowed aggregate, being mixed and remixed until of proper texture and color is produced.

After mixing, both windrows shall be bladed together along the center of the roadbed and left undisturbed for primary curing for whatever length of time the Engineer may require, as determined by prevailing temperatures and other conditions. If, after such curing, further mixing shall be necessary, the windrow shall be divided and remixed as required by the Engineer, and deposited again in windrows along both shoulders; and none shall be placed on the roadbed until both the mixture and the fine grade have been approved by the Engineer.

No liquid asphalt shall be spread or mixed when the air temperature is below 60° F, during unfavorable weather, or when the moisture content of the aggregate exceeds 3% by weight of the dry aggregate.

The County Highway Department shall be notified one day (24 hours) before completion of the spreading and compacting in order that inspection for acceptance may be made. The Engineer will have ma-

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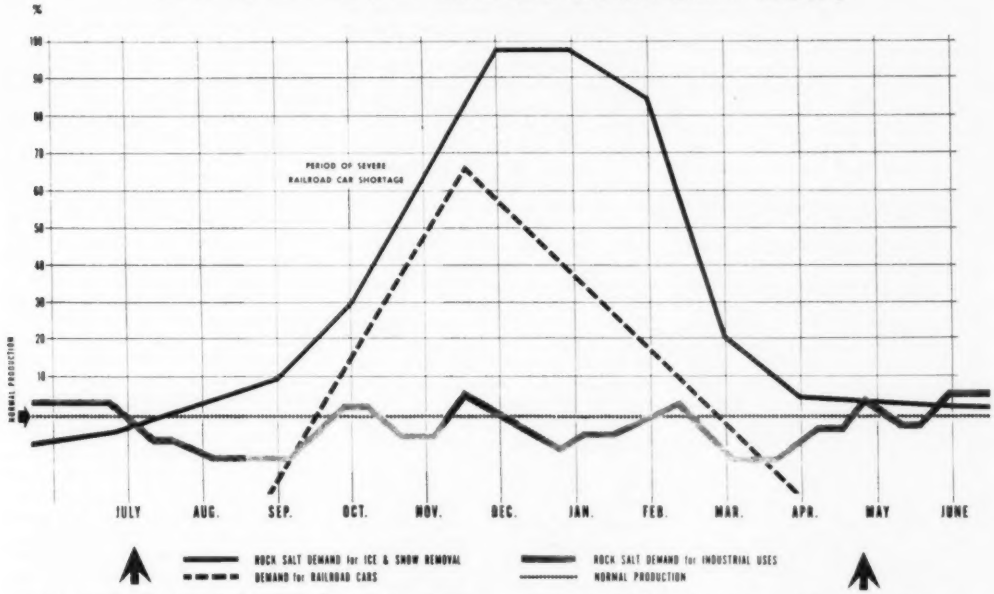
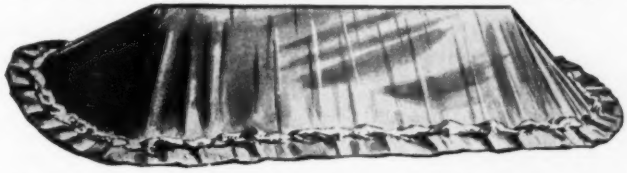
. . . 3 strikes against you already but you're still not "Out." So look at the chart below and save disappointments and delays by ordering your CAYUGA ROCK SALT *now!*



"A smart man buys before snow flies." 75% of next winter's salt should be in your bins before October 1. Look at the chart above and you will see what we mean. Notice the terrific Rock Salt demand between September and March. Note, too, the shortage of freight cars during September, October, November, and December. These are the months you will want Rock Salt in a hurry for highway snow and ice removal. Help us to help you by sending your order *now*, while we can make deliveries promptly.

RAYN-SHED

EARLY STOCKPILING IS YOUR ANSWER



RAYN-SHED is a durable, water-tight, weather-resistant vinylite plastic sheet, carefully sewed into large strips which in turn may be cemented together on the job to form even larger coverings. Standardized to cover 2 to 20-car bulk piles or piles of bags.

RAYN-SHED coverage costs about 30 - 65¢ per ton, according to pile's size and shape. Cost is so low you can discard if you wish after a single season. Pile your CAYUGA Rock Salt on any hard surface—an old road strip or tar paper. Then cover easily, quickly with RAYN-SHED.

RAYN-SHED is developed by and is available through Chemical Corporation of Springfield, Mass. Write us for Data Sheet for estimating sizes needed for your salt storage.

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THE CHEMICAL CORP., 54 Waltham Ave., Springfield 5, Mass. Phone 9-5601. Warehouses: Pittsfield, Mass. Phone 2-0718. Boston, Mass., 30 Boylston St. Phone LIberty 2-7171. Hartford, Conn. Phone 6-3233. Concord, N. H. Phone 3394. New Haven, Conn. Phone 8-3827.

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KERR SALT CO., 901 S. Wolfe St., Baltimore 31, Md. Phone WOlfe 0282.

E. J. FEDIGAN INC., Pittsburgh 12, Pa., Anderson & Isabella Sts., N. S. Phone Ceder 1-6766.

YOUNGSTOWN BUILDING MATERIAL & FUEL CO., Youngstown 4, O., 1505 Logan Ave., Phone 3-4101.

OBRECHT SALT CO., 1225 Key Hway, Baltimore, Md. Phone SARatoga 2370.

INDUSTRIAL SALT SERVICE, A Div. of Highway Materials Co. Inc., Groton, N. Y. Phone Groton 154. Branch Warehouses: Congers, Rockland Co., N. Y; Niagara Falls, N. Y. L. V. R.R. Co. Roundhouse.

A. F. NILSON, Sales Engineer, 13 Mercer Ave., Chatham, N. J. Phone 4-7003.

CAYUGA ROCK SALT CO., INC., MYERS, N.Y.

terials tested for compliance with specifications. Upon approval, placing and compacting may take place.

The mixed material shall be bladed back and forth across the roadbed to a depth of three-quarters of the final finished thickness and the surplus windrowed to both sides of the width to be paved. This layer shall be compacted with a pneumatic roller of approved type, as many passes being made as may be necessary to obtain maximum compaction. The rolling shall be done longitudinally and progress from edge to center in all cases. Prior to the final spread, the exposed compacted surface shall be covered by one pass with a power tandem roller of approved type to press down all extruded coarse aggregate.

The remaining material shall then be bladed back and forth to uniform thickness over the full required width and compacted with the pneumatic roller, as above. Finally, the entire width shall be bladed and all loose coarse aggregate swept to the shoulder areas. The full area shall then be rolled with a power tandem roller of approved type weighing not less than 10 tons. The rolling shall start at the edges and progress to the center, and shall be continued until a uniformly smooth surface is obtained.

After all grading and paving have been completed, and prior to acceptance by the Engineer, the contractor shall remove all equipment, surplus material, rocks, and trash of every kind from the entire width and length of all roads and streets covered by the contract, and the entire site shall be left in a neat and orderly condition.

Within 24 hours from the time of completion of clean-up, the County Highway Department shall be notified in order to provide inspection. Such inspection shall not relieve the contractor or owner of any of his obligations to fulfill his contract as prescribed. Defective work shall be made good and unsuitable materials may be rejected.

Curb and Other Concrete

The County Highway Department shall be notified if the owner or contractor elects to install curbs and/or other concrete structures for a subdivision. Tests of cement, sand and coarse aggregate will be made by the Department in order that a Class "A" concrete will be provided. A fee, estimated by the Department, as sufficient to cover the actual cost of the tests will be deposited. Reports from approved commercial laboratories will be accepted in lieu of the above.

Class "A" Portland cement concrete shall be composed of Portland cement, fine aggregate, coarse aggregate and water, proportioned and mixed as specified by Section 60, Standard Specifications, State of California, Department of Public Works, January, 1949.

Subgrade requirements are essentially the same as those required in the first portion of this article.

Forms must be of good, sound lumber, which shall be not less than 1⅝ ins. thick after being surfaced on one side, which side shall be placed next to the concrete. Curb forms shall be set carefully to alinement and grade and to conform to the required dimensions of the curb. They shall be rigidly held in place by stakes of such size and length, and set at such angles as may be necessary. All forms shall be cleaned thoroughly each time they are used and coated with a light oil, as necessary.

The form on the front of curbs shall be removed in not less than two hours nor more than six hours after the concrete has been placed. Forms on the back of curbs shall remain in place for at least one hour after the grout has been applied to the curb. In no event shall the form be removed while the concrete is sufficiently plastic to slump upon removal of the form. All forms shall be constructed in a substantial and workmanlike manner.

Mixing, Placing and Finishing

A mechanical batch mixer, minimum one-sack approved type, shall be used in mixing the concrete. Speed, consistency and mixing time shall be in accordance with the Engineer's direction. Transit-mix concrete may be used in lieu of the above, when approved by Engineer. The concrete materials shall be mixed with only sufficient water to produce a concrete which will hold its shape when struck off with a template. There shall not be any separation of the mortar from the gravel in handling. The consistency of the concrete shall be determined by ASTM test C-143 with a minimum strength of 2500 psi at 28 days.

After mixing, as specified above, all concrete shall be deposited in its proper place without delay in a continuous operation. The subgrade shall be thoroughly wetted immediately ahead of the placing of the concrete, but no pools of water or chopped up subgrade will be permitted.

By means of an approved type of template, the concrete is to be brought to a true, uniform, hard and dense surface, conforming to approved grades and cross-sections. The surface shall be free from any unevenness greater than ¼ inch, measured from a straight edge 15 ft. in length.

An interval of more than 45 minutes between any two consecutive batches or loads, or a delivery or placing rate of less than 8 cubic yards of concrete per hour, shall constitute cause for a construction joint at the location and of the type directed by the Engineer in the concrete already placed.

All concrete curbs shall be plastered on the outer or gutter face and over the whole top with a ¼-inch finishing coat of cement mortar composed of one part Portland cement and two parts sand. The finishing coat shall be well floated, smoothly trowelled and finished and marked off in blocks not longer than 5 ft.

Joints

Expansion joints ½ inch thick shall be installed in curbs and gutters at 60-ft. intervals, and in curbs at the ends of all returns. Expansion joints shall be filled with joint filler strips ½ inch thick conforming to the requirements of Section 66, State Standard Specifications. Weakened plane joints shall be installed at 20-ft. intervals.

Expansion joints and weakened plane joints shall be installed at right angles to the line of the curb.

Construction

Driveway entrances shall be of the dimensions designated by the Engineer, and the curb shall be cut away to one inch above the gutter grade. The top of the curb at entrances of driveways shall be finished on a slope, the back edge being one inch higher than the front edge.

The owner and/or contractor shall repair and clean all concrete damaged or discolored during construction. Where any curb requires repairs before acceptance, the repair shall be made by removing and replacing the entire curb between scoring lines and not by refinishing the damaged portion.

The surface of all finished curb shall be covered with sand or earth and kept covered for 7 days. Said covering of sand or earth shall be kept thoroughly wet during said 7 days.

Alternating Double Filtration of Sewage

EXPERIMENTS in the development of the process of alternating double filtration of sewage have so far been carried on by the British Water Pollution Research Laboratory using circular filters with rotating distributors. In order to simulate the working conditions in rectangular filters (in which the sewage distributors travel backwards and forwards along the length of the filter, with a consequently greater interval between successive applications than occur when circular filters are used) the distributors on one pair of the circular filters used in the experiments were driven mechanically at a much slower rate than is normal when rotation by reaction is used. It was found that the lengthening of the interval between applications of sewage had no adverse effects on the process, but appeared to lead to a slight improvement.

During twelve months of experimenting with the biological filtration in pilot plant of sewage at various rates between 100 and 1,000 gallons per cubic yard of medium per day, it was found that at the highest rate eight times as much oxidizable matter was removed daily as at the lowest.

A study was made simultaneously of the mechanism of biological filtration and it was found that the period of contact of sewage in the filters ranged from 110 minutes at 100 gallons per cubic yard per day to 20 minutes at 1,000 gallons per cubic yard per day. There appeared to be a very rapid removal of oxidizable matter in the surface layers of the filters. Oxidation in the lower part of the filters followed a monomolecular law with a much higher reaction constant than has been recorded for other methods of treatment.

A great improvement in the quality of the effluent was obtained during experiments at Luton sewage-disposal works on mechanical filtration for the removal of humus from sewage effluent. Good results were secured with rapid gravity filters and with microstraining.

A complete mixture of waste waters from a paper mill using mainly rag and hemp as raw materials, was successfully treated in a percolating filter during pilot plant experiments. Neutralization of the strongly alkaline waste "black liquor" was unnecessary when it was mixed with other waste waters, the dilution and buffering effect giving a mixture of suitable pH value for treatment in the percolating filter. During these experiments the liquid was dechlorinated before filtration but in later experiments it was found that small-scale filters could tolerate up to 12 parts of combined residual chlorine per million.

The annual report, from which the above is summarized costs 40 cents and may be procured from Dept. of Scientific and Industrial Research, Charles House, 5-11 Regent St., London SW 1, England.

Skew Dummy Joints for a Highway

In reconstructing U. S. 80 in San Diego County, Calif., an experiment is being tried on a half-mile of 24-ft. concrete pavement. The dummy joints, made with strips of premoulded material, were placed on a skew of 2½ feet in 12 feet. It was found to be no more difficult to place the skew joints than the usual 90° ones, and it is expected to result in a smoother riding job since wheels of a vehicle will not cross the joint simultaneously.

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This M & H mechanical joint Cutting-In Sleeve makes it easy to install a mechanical joint or a hub end gate valve or pipe fitting into an existing pipe line. Out of the pipe line cut only a length of pipe equal to the over-all length of the valve or fitting to be installed, plus 9 inches. The mechanical joint Cutting-In Sleeve is then telescoped over one of the cut ends, the valve inserted into position and the Sleeve pushed back to socket into the valve bell. The joint is then bolted up if it is mechanical joint valve, or poured and calked if hub end valve. For complete information, write or wire M & H Valve and Fittings Company, Anniston, Alabama.
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HTH Controls Activated Sludge Plant Index

WILLIAM H. GRUBB,
In the "Digester" of the Ill. Dep't. of Health

AT the Dwight State Reformatory for Women we have a small activated sludge plant which handles a 24-hour flow totalling 32,800 gals. This is domestic sewage and laundry waste. The bulk of the flow occurs during a 12-hour period with the greatest flow when the laundry is operating. During this period, we have a very high surface settling rate in the final tank. We need close control of the sludge index if we are to operate satisfactorily. We have tried many things, including HTH in solution, from which we derived no benefits.

We then started to add HTH directly to the influent end of the aerator, in its dry state, and in total daily doses or slugs. We found that we could control the index very closely and at no time during a 2-month experiment did we injure the activated sludge by over-chlorination. During the first month of experimental work we added 23.75 pounds of HTH per million gallons, but later reduced this to 13.25 pounds per mg with satisfactory results.

Due to the high surface settling rate in the final settling tank we operate with a bulked sludge which enmeshes fine floc and produces a sparkling effluent. With the use of dry HTH, we get quick results, as our settling curves show a decided improvement in a matter of 2 hours. BOD removal is very satisfactory.

• • •

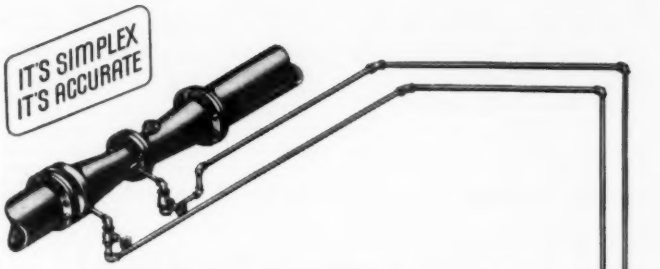
Algal Toxins

(*Continued from page* 55)

studies used mice instead of guinea pigs as the experimental animal. The minimum lethal dose apparently varied a great deal depending on condition, and the symptoms were much the same as previously described for other animals.

The chemical nature of the toxin has not been determined as yet, although it is generally conceded to be water soluble, heat stable either, wet or dry, and resistant to extreme pH changes. The algae in dry preparation seems to hold their toxicity for long periods of time. Olson reports that progress is being made in the isolation and separation of the toxic fraction. The algae most generally associated with outbreaks are, Bluegreen Micro-

IT'S SIMPLEX
IT'S ACCURATE



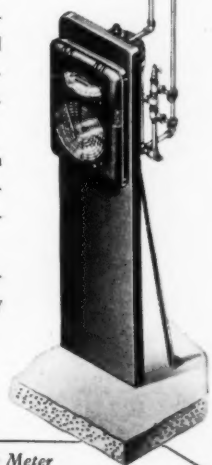
SIMPLEX TYPE H
VENTURI METER

The Simplex Type H meter is designed specifically for use with Venturi Tubes, Flow Nozzles or Orifice Plates. It measures, with a high degree of accuracy, hot or cold water, process liquors or gases, under high or low pressure conditions. When used with appropriately designed Venturi Tubes, measurement of sewage or sludge may be accomplished with equal accuracy and ease.

This meter is built with maximum differentials of 114" or 64" of water to measure over ranges of 13 to 1 and 10 to 1 respectively. Standard design includes indicating, recording and totalizing features but, if desired, it may be furnished with various combinations of these elements.

Versatility of installation is attained through its various forms of mountings and its adaptability to different pressure conditions, particularly those of low pressure.

This instrument is one which may be recommended without hesitation whenever accuracy and long range of measurement are required.



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cystis flosaquae, Gloeotricha pisen, Anabaena flosaquae, Aphanizomenon flosaquae Microcystis aurugi-nosum, and Nodularia spumigera.

Can Humans Be Affected?

If anyone wishes to conjecture on the possibility that algae may cause gastro-intestinal disturbances in humans, he should read the report of E. S. Tisdale on an epidemic of intestinal disorders in Charles Town, W. Va., occurring at a time when there were unprecedented water supply conditions. (A.J.P.H. 21: 1931.) According to this report in the fall of 1931 around 8,000 people were afflicted with severe gastro-intestinal upsets. This illness appeared at a time when the river which was used as a source of drinking water was unusually low, the water warm, and extensive growth of blue green algae present. It is important to note that the water plant was run faultlessly and bacteriological findings taken daily by the State Health Department showed the water to be free from coliform bacteria and to conform to the U. S. Public Health Service requirements. One theory advanced is that algae toxins may have filtered through, and may have been responsible for the intestinal upsets.

There are other evidences that algae toxins may affect the health of man. Eating an animal which has died from algae poisoning may pass the toxin on to the consumer. There are various records where cats and dogs, eating parts of animals, birds or fish presumably killed by algae toxins, have died, apparently from secondary poisoning.

Although evidence and symtomology concerning animal and human mortality in sickness from toxins associated with heavy algae blooms in water is not definite or clear cut, there is sufficient information to indicate the danger of algae poisoning. Persons in the Public Health and Stream Pollution fields should therefore recognize the possibility of such poisoning and take measure to prevent such water from being used as a source of drinking water for both animals and humans.

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PUBLIC WORKS DIGESTS

THIS section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.

SEWERAGE AND REFUSE . . 67
HIGHWAYS AND AIRPORTS . . 74
WATER WORKS . . 81

THE SEWERAGE AND REFUSE DIGEST

Phenol Destruction By Chlorination

The country's first full-scale commercial waste treatment plant to destroy phenols by chlorination has been completed by the Pequanoc Rubber Co. of Butler, N. J. The waste from this plant includes oils of the terpene family which contains phenols. Trickling filters and other processes were found to be ineffective, and experiments showed chlorine to be the most economical dephenolizing agent for these particular wastes, and also it removed color. Copperas was found to be the best coagulant; and lime to be best for control of pH, which must be kept above 7.0. Pumping wastes through the chlorinator injector minimized chlorine odors better than applying chlorine solution; chlorine retention time of at least 3.5 hr. was necessary. When dephenolized alkali wastes are added to acid wastes, residual chlorine in the former is consumed by the acid waste and reduces its color. The plant treats 50,000 to 60,000 gpd of alkali wastes and 250,000 or more of acid waste in intermittent operation over the 24 hr. Sludge is pumped to lagoons. Phenols are completely destroyed, color reduced 75% and odor 60%. The cost of chlorine, lime and copperas is about 1.25¢ per gallon of wastes treated.

"The Country's First Commercial Phenol Destruction Unit;" *Engineering News-Record*, Jan. 10th.

Disposing of Vacuum-Filter Sludge

Up to 1939, Baltimore, Md., dried its digested sludge on 13.3 acres of sludge drying beds to a moisture content below 70%, which the farmers hauled away for fertilizer. Since that year the sludge has been dewatered by vacuum filtration. The sludge from the filter had a pasty consistency which made it unacceptable to the farmers, and little was removed between 1943 and 1949. Instead, the sludge cake was deposited to a depth of 4 or 5 ft., over an area that had reached approximately 100 acres. During the period of storage, the sludge had decreased in moisture from 74-78% to 25-40% on the surface and 50-70% a foot below the surface. By extensive advertising in the local papers farmers were again interested in it, and hauled it away at times at the rate of 600 tons a day. The city is now constructing a $2,100,000 drying plant containing three flash dryers capable of producing 75 tons of dry solids daily, which will be sold to producers as a base for complete fertilizers.

C. E. Keefer—"Mechanical Handling of Vacuum Filter Sludge Cake;" *Water & Sewage Works*, January.

Trickling Filter Bed Construction

In constructing eight new circular trickling filters at the Fort Worth, Texas, treatment plant in 1951, several new ideas were used in the details of construction. The underdrains are Translot blocks. Each filter has an annular air vent channel 5 in. deep by 16 in. wide just inside the wall, with vertical 8-in. vent pipes leading from it at 18° intervals. The cover of the effluent channel was made by laying, side by side with ¼-in. spaces between, 40-in. lengths of 8-in. vitrified clay pipe filled with concrete, reinforced at the bottom with two ½-in. rods. Each end of each cover pipe overlapped the channel wall 5 in.

The underdrain blocks were brought to the filters by truck from the manufacturer's plant 55 miles away, stacked on 3 x 3 ft. wooden pallets which were removed from the truck and lowered to the bed with a two-pronged fork attached to a scoopmobile. A 5 man crew placed the blocks on a ½-in. bed of dry sand-cement mortar mixture at the rate of 2200 blocks a day. The specifications for placing the stone medium were especially rigid. They provided that it be placed by use of a belt conveyor, or boxes using a crane boom, or other method that does not require traffic of any type over the stone already placed. Immediately prior to placing it must be passed over a screen with openings not less than 1 in. square. The contractor used boxes of 2 cu. yd. capacity with a bottom trap door. Final leveling of the stone was done by means of a steel drag harrow.

W. S. Mahlie and Norman G. Winder—"Filter Stone and Underdrain Specifications and Placement;" *PUBLIC WORKS*, February.

Treating Tank Car Wastes

The wastes from the cleaning of tank cars are unusually complex and variable in composition and in flow. They have a rather high BOD loading and may be quite toxic to biological life. An average waste contains 31.29% petroleum products, 12.23% oils and fats, 5.52% acids, 3.97% alkalies, 5.52% soluble organic chemicals. The treatment

adopted by the General American Transportation Corp. is based primarily on the adsorption at the surface of hydrophobic solids of toxic materials such as phenols, cresols, naphthalenes, etc., as well as of emulsified oils. The absorbent used is bituminous coal. When it is brought into contact with an emulsion or solution of nonpolar or polar-nonpolar compounds in water it extracts the compounds by adsorption. The coal used at this plant requires 40 min. to reach the point where practically no more adsorption takes place. In treating the wastes, first, solids are removed in a sludge basin, oil in a separator and other insolubles in a third basin, the effluent from which goes to a turbo-conditioner, where coal previously wet-ground and passed through a 35-mesh screen, is added. The pH is automatically controlled at 4.5-6.5 and the slurry flows to a bank of three turbo-floaters which disperse minute bubbles of air throughout the slurry. The foam produced contains 20-25% concentration of coal particles, which foam is scraped from the surface and dewatered on a vacuum filter. The filter cake is dried for use as fuel, the adsorbed oils and organic matter increasing its caloric value.

Gregoire Gutzeit and Glenn Enyart—"Tank Car Wastes Treated by Chemi-Adsorption;" *Wastes Engineering*, January.

Here is the Board of Directors of Associated Equipment Distributors, taken at the recent Chicago meeting.

Safety Equipment For Sewer Maintenance

Equipment used by the Sewer Maintenance Division, Los Angeles, Calif., for safety in underground work includes a portable ventilator. All sewers, storm drains and appurtenant structures are considered dangerous until checked. An air-hose-type mask with pump is used; also the canister-type mask. The Mine Rescue type oxygen breathing helmet with auxiliary oxygen tank and the Chemox oxygen mask are used in rescue work or where very dangerously explosive or poisonous gas exists. The explosimeter is used in checking 350 to 500 manholes a day for explosive conditions. Hard hats should be worn by all

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men working in underground structures in excavations. Steel toes for protecting the feet are a precaution for men using jackhammers, cutting concrete, etc. Explosion-proof lights; portable poison gas indicators, safety belts and ropes are necessary. Ladders should be long enough to extend at least 2 ft. above the surface of the ground; they should be used in all excavations more than 5 ft. deep. Rubber boots should be used while working in sewage or very damp places. The use of strong soap, paper towels and wiping rags is of primary importance. A list of conditions and locations that should be considered especially dangerous is given, special consideration being given to removing a sewer stoppage, since removal of this may bring down onto the workmen a sudden rush of the dammed-up sewage.

F. W. Brown—"How to Be Safe While Maintaining Sewers;" *Wastes Engineering*, January.

Reconditioning Diffuser Plates by Thermal Spalling

A new method of reconditioning aerator diffuser plates has been developed by Richard C. French, of the N. Y. Bureau of Sewage Disposal Operations, which he calls thermal spalling. The 36,000 plates in the Wards Island plant with a permeability of 20 became clogged after a few years. Some were replaced with others of 40 permeability. These also became clogged after a year and a half. Washing and scrubbing with brushes and ammonia gave only temporary recovery, and the full blower pressure of 9.5 lb. per sq. in. would not force enough air through the plates to operate the plant properly. Dry-sand and wet-sand blasting gave only temporary relief and were costly; moreover it was found that they filled the pores of the plates with powdered sand. Also that most methods of washing resulted in imbedding the clogging material deeper into the plates. So, with the cooperation of the Linde Air Products Co., he developed a method of removing a thin scale from the top of the plates, including the clogging material by thermal spalling. By using 0.8 of a cu. ft. of both oxygen and acetylene per plate per pass, 1/40 inch was removed. The number of passes was varied according to the depth of the clogging. Because the plates are porous and made of material that does not conduct heat rapidly, it is possible to so raise the

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heat of a thin layer as to cause it to spall off. A special head is used on the oxyacetylene burner which gives a temperature of about 5,000°. The spalling leaves the surface almost as smooth as before. In a later contract 1/20 inch was removed per pass made in 20 sec. This cost $6,874 for 40,436 plate passes. Some plates received three or less such cuts, others required more cuts, some running as high as 9 cuts, giving a loss of 0.42 inch. After the top of the plates has been spalled it is possible to remove the bottom clogging by the writer's jet-washing method, using wetting agents and detergents. It is estimated that this method of reconditioning is worth much more than the cost, as it more than doubles the useful life, reduces the condenser pressure at least a pound, and gives better results in the treatment according to experience and records so far available.

Richard C. French — "Flame-Spalled Diffuser Plates Improve Sewage Aeration;" *American City*, January. (See also *Public Works*, Jan., 1950.)

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Subdivision Sanitation in Rural Areas. By *J. A. Salvato Jr.*, Chf. Bur. of Gen'l. San., Erie Co., N. Y., Health Dept. February, Pp. 66-68, 80.

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Paint Protection of Sewage Works Structures. By *W. T. McClenahan*, Construction Eng., San. Dist. of Chicago. January, Pp. 1-23.

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Procedures for Sampling and Measuring Industrial Wastes. By *Hayse H. Black*, Chf. Industrial Wastes Sec., U.S.P.H.S. January, Pp. 45-65.

Waste Pickle Liquor Treatment and Disposal. By *Thos. F. Reed*, Chem. Engr., U. S. Steel Corp.; *Grant A. Pettit*, Armco Steel Corp.; *H. A. Cubberley*, Gen'l Supt. Walker of Conshohocken; *C. J. Lewis*, Tech. Dir. Warren Co.; and *John H. Harper*, V. P., Industrial Wastes, Inc. January, Pp. 66-82.

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Mechanical Handling of Vacuum Filter Sludge Cake. (At Baltimore, Md.) By *C. E. Keefer*, Deputy Sew. Engr., Baltimore. January, Pp. 36-37.

Rapid Photometric Estimation of Process Efficiency. By *W. Wesley Eckenfelder, Jr.*, Cons. San. Chemist. January, Pp. 38-43.

County Road Construction With Emulsified Asphalt

This is a portion of a paper by Ben T. Collier before the 50th meeting of the ARBA. Mr. Collier is with the Mississippi State Highway Department.

A SECTION of emulsified asphalt double surface treatment 6.3 miles long was completed last November in Clarke Co., Miss. The work was done by contract at a cost of $10,000 per mile. This included drainage structures; light and heavy linear grading; a 6-inch base of local friable material stabilized with washed gravel; and lime, fertilizer, and seeding. This project was originally designed for crushed aggregate, but the demand for crushed aggregate in the coarser sizes exceeded the supply at the time of construction. To enable the completion of the job during that year's construction season, specifications were changed to permit readily available uncrushed gravel for the coarse aggregate application. Approximately 0.45 gal. of high viscosity quick breaking emulsified asphalt per square yard was applied on the primed sand clay gravel base of six inches compacted thickness. The temperature of the emulsified asphalt during its application was kept at approximately 140°F. There was no evidence of pooling or run-off. This was covered with approximately 0.5 cu. ft. per sq. yard of clean uncrushed gravel, and rolled. This first course of gravel was placed the full length of the job before the second applications of emulsified asphalt and finer aggregate were begun, and traffic was not rerouted at any time during construction.

Aggregate Gradings

The gravel aggregate met the following gradation requirements: 100% passing 1¼-inch screen; 95%-100% passing 1-inch; 30%-60% passing ¾-inch; 0-10% passing ½-inch; and 0-3% passing No. 4. The high viscosity asphalt emulsion contained approximately 65% residual asphalt, and had a minimum demulsibility of 75. The placement of the second aggregate course began immediately upon completion of the mat course. The same grade of emulsified asphalt was applied at the same temperature as for the first course, at the rate of 0.38 gallon per square yard, covered with .28 cu. ft. of crushed slag, and rolled. The finished job shows a high percentage of retention for both types of aggregate, has a uniform texture, and excellent non-skid characteristics.

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Hinds County, Mississippi in the Fall of 1950 built a 4.6 mile, 2½ inch asphaltic concrete surface 20 ft. wide, on a 6-inch sand clay gravel base, using regularly employed county labor and county owned equipment. Only one member of the construction crew had had any previous asphaltic experience, but this job was completed in less than thirteen calendar days, or ten working days. A nearby creek bar was the source of the sand gravel aggregate.

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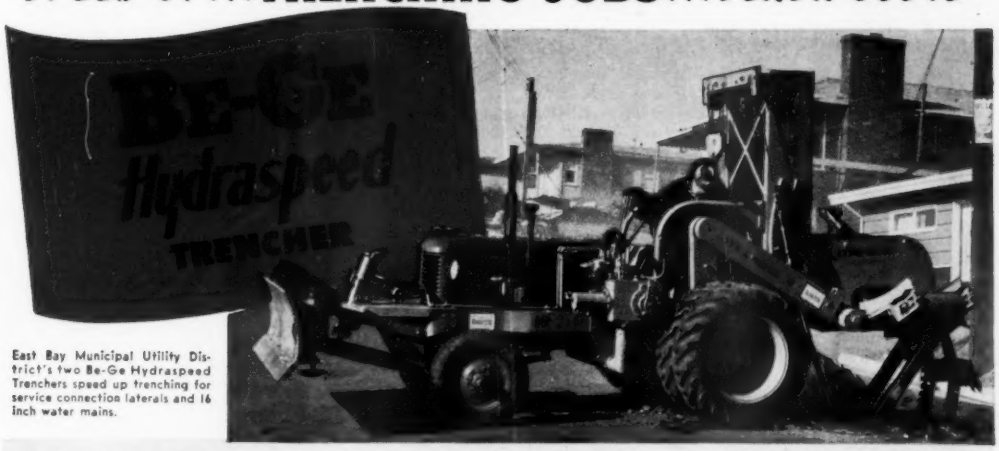

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which was picked up by clam shell, scalped through a 1¼ inch vibrating screen to remove oversize, and dumped at calculated intervals on the roadway by contract for $1.60 per cubic yard. Construction procedure was so planned as to permit continued hauling of aggregate, bituminous application and mixing, aeration, and compaction to be underway simultaneously. The equipment consisted of one 1000-gallon distributor, one 850-gallon distributor, three motor patrol graders, and one 8-ton tandem roller. The construction crew consisted of operators for the above equipment, 3 common laborers, and 1 sub-foreman. The job's total cost including labor, equipment rental, aggregate and emulsified asphalt amounted to somewhat less than $22,000 or just under $4,700 per mile. A seal coat of quick breaking emulsified asphalt and crushed slag was planned for the following year, but since there was no evidence whatever of abrasion or ravelling, this seal is no longer contemplated for the immediate future. The roadway is still in excellent condition after more than a year of heavy farm to market traffic, including consistent use by heavy log trucks supplying a nearby lumber mill.

• • •

Procedure for Rating Water Current Meters

RECORDS of the flow of water in rivers and streams are important as bases for predicting future flow. Such predictions in turn have great economic importance. Extensive water-flow data have therefore been collected for many years by various governmental and private groups in the United States. For more than three decades, the National Bureau of Standards has rated (calibrated) nearly all the water current meters used in this country for measuring flow of rivers and streams, as well as many meters from foreign countries.

Calibration requirements for water current meters have become more severe each year, particularly in connection with reclamation, irrigation, flood control, and water power projects. Demand for NBS calibration services has grown constantly, and about 1200 meters are now rated annually by the NBS hydraulic laboratory.

In measuring the total flow of a river or stream, a properly calibrated meter is lowered into the stream and the water velocity measured at a number of points. By sounding for depth across the channel the engineer can determine the cross-sectional area of the stream. The cross-section is then divided into a number of sub-areas, and the flow through each sub-area is computed from the average velocity through it. The flows through the various sub-areas are then added up to give the total flow.

Meters for stream gaging may be of either the propeller or turbine type. In either type the speed of the rotating element, measured by a counting device, depends on the velocity of the water flowing past it. An electrical contact mechanism does the counting in most meters, while mechanically-actuated recording counters are used in others.

Water current meters are rated at NBS by towing them through still water at accurately known speeds and observing the resulting meter indication. In the NBS installation, the only one in the country generally available for this purpose, a railroad-type towing car rides above a still-water channel

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400 feet long, 6 feet wide, and 6 feet deep. Running on carefully aligned steel rails, the car carries its own electric motor. An oil-hydraulic speed-control system permits continuous speed change; or any speed from 0.05 to 14 miles per hour can be held substantially constant during a test run.

Many precautions must be taken to insure reliable results. For instance, great care is used to prevent bumps and vibrations in the motion of the car. Any vibration will be communicated to the meter and may seriously affect its operation, particularly at low speeds. Although the wheels and the rails have been ground to a smooth finish, it has been found that any accumulation of dirt or rust will cause objectionable vibration of the car. Brushes are therefore mounted on the car to sweep the rails automatically.

Meters are supported during calibration in a manner as nearly identical as possible to that which will be used in the field. This is necessary in order to avoid calibration errors, since experience has shown that the slightest change in the meter mounting yields a different rating curve. In the field, meters are either supported by vertical rods or are weighted and suspended from cables, depending on the depth of the stream. The NBS laboratory is therefore equipped with a complete set of both rod supports and cable suspensions.

In making a test run, the rating car is first brought up to the desired speed, as indicated by a stroboscopic disc. A signal from the meter then causes a dart to be shot into a distance scale alongside the water channel, and simultaneously starts a timer. After a predetermined number of revolutions of the meter, the electrical control mechanism automatically shoots another dart into the distance scale and stops the timer. The velocity and the number of revolutions per second can then be computed from the distance between the two dart positions, the time, and the number of revolutions of the meter. Plans call for simplifying the procedure slightly by measuring the distance with an automatic recorder geared to the non-driving wheels of the car, thus eliminating the darts.

When rating a meter at least six pairs of towing runs are made, each about 100 feet in length, at velocities representative of the range for which the meter is to be used. By making pairs of runs in opposite directions at the same speed, the effect of any currents present in the tank is cancelled. An interval of about 5 minutes must be allowed between runs for the disturbances created in the water to die down.

Ratings are usually presented graphically for use in the field (revolutions per second plotted against velocities in feet per second). Although the rating curve of an ideal frictionless meter would be a single straight line, actual meters fall slightly short of the ideal. For practical purposes, however, sufficiently accurate results are usually given by two straight lines, one for lower and one for higher speeds. Greater accuracy may be obtained by computing rating equations from the observed data, using automatic calculating machines.

High precision is realized in NBS water meter ratings. Analysis of a large number of ratings indicates that the probable error of each observation even at low speeds is only 0.5 percent and improves to 0.2 percent at higher velocities. This order of precision, high for hydraulic measurements, is more than adequate for the practical field uses to which the meters are put.

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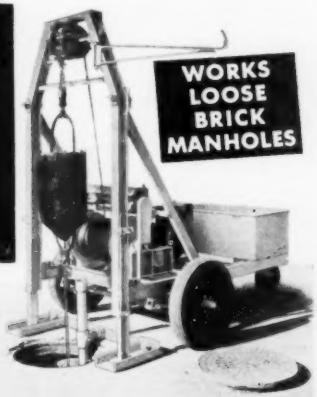

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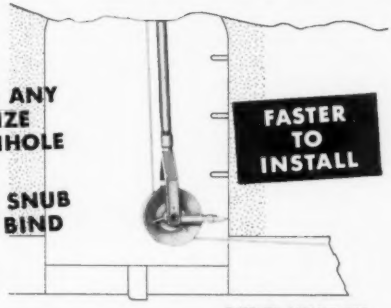

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Mechanical Equipment Used on Michigan Highways

The Michigan State Highway Dept. uses mechanical equipment to the greatest extent possible to effect economy, speed of operation and better results than can be obtained manually. Some of their newer equipment includes: Hopper-type, truck-mounted, self-unloading *sand spreader* for ice control; greatly reduces cost, being operated by one man, distributes sand more evenly, and is safer for operating personnel than trailer type spreaders. Self-propelled transverse pavement *joint cleaner;* a one-man unit on pneumatic tires; gives greater maneuverability and economy. Rubber *joint filler;* non-extruding, keeps joint filled. *End loaders* on trucks; driver loads his own truck with roadside trash and leaves and street sweepings. *Chain saws,* trim trees more quickly and at greatly reduced cost. *Chemical sprays* reduce amount of mowing required and, by control of brush, keep sight distances clear and reduce amount of ditch cleaning necessary. Chipper-type *brush disposal* units, eliminate brush burning, chips used as roadside mulch. A bituminous *pavement planer* eliminates resurfacing of rough pavements. *Post drivers,* with a light-duty hammer driven by air compressor, permits rapid placing of posts for signs at less cost.

Burleigh R. Downey—"Special Equipment Speeds Michigan Maintenance;" *PUBLIC WORKS,* February.

Highway Subdrainage

Highway drainage designs have generally been based on empirical rules. The authors of this report present test methods and data on permeability and drainability of soil, describing apparatus for making the tests and method of using it and applying the results to subdrainage.

Results of permeability tests on various materials with appropriate apparatus show the importance of detailed specifications of procedure and materials and the extremely wide range of possible values. For instance, the permeability of a material depends on the method of its compaction as well as its density, gradation, and plasticity.

Substitution of test results in appropriate formulas illustrates the effect of boundary conditions and the coefficient of permeability on the rate of drainage. It is shown that the small gradients available for lateral drainage of base courses prevent rapid drainage of dense-graded materials on impervious subgrades. Even after drainage a dense-graded material will hold considerable water by capillarity if protected from evaporation. While open-graded materials will drain more readily, provision must be made to prevent intrusion of fine subgrade soil, and it is difficult to compact them so that traffic will not cause further displacement.

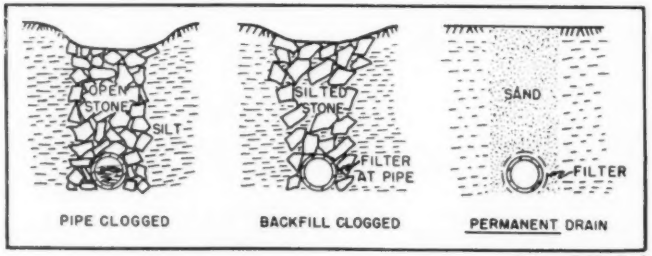
Since both density and drainability are desirable, the range of satisfactory materials is limited, and it is sometimes necessary to choose which property should be given preference.

Concerning the construction of drains, the authors say:

Subsurface drainage of soil in cut slopes and under pavements is often accomplished by the use of drain tile or perforated pipe placed in a trench and covered with a granular material. The granular material is commonly designated as the filter. If the voids of the filter material are very much larger than the finer grains of the soil to be drained, the fine soil particles are likely to be washed into the pipe or into the interstices of the filter (left and center sketches in the illustration), where they accumulate and gradually obstruct the flow.

When the finer particles of the filter material at or near the plane of contact with the soil can hold back the coarser particles of the soil, infiltration or clogging will not be sufficient materially to impede the drainage. Thus, as shown on the right, replacing coarse gravel with sand as backfill in drainage trenches in silt soils prevents the otherwise inevitable intrusion of silt into the gravel. The sand may be kept out of the pipe by putting gravel around open joints or by using perforated pipe with the perforations down.

The criterion suggested by Terzaghi and tested and adopted by the Corps of Engineers to prevent intrusion in drain backfills is to require that the piping ratio of 15-percent size of filter material to 85-percent size of material to be



Courtesy Public Roads

● ***HOW silt may clog highway subdrains.***

drained be equal to or less than 5. For plastic clays with sand or silt partings (extremely thin seams) the 15-percent size of the filter—the size than which 15 percent by weight is finer—should be compared to the 85-percent size of the sand or silt. For fractured clays without partings, the 15-percent size of the filter need not be less than 1 millimeter regardless of a smaller value indicated by the piping ratio, because the cohesion of the clay will withstand the seepage forces.

To keep the filter material out of the pipe, the Corps of Engineers requires that the ratio of 85-percent size of filter to pipe opening (perforation or slot) be equal to or greater than 2, which may indicate the desirability of two layers of filter material. To insure adequate permeability in the filter, it is required that the ratio of 15-percent size of filter to 15-percent size of material to be drained be equal to or greater than 5. The Connecticut State Highway Department uses higher piping ratios which increase with the uniformity coefficient of the soil.

E. S. Barber and C. L. Sawyer —"Highway Subdrainage;" *Public Roads*, February.

State Aid for Iowa's County Highways

Securing the more rapid surfacing of county roads in Iowa, making the best and most economical use of available materials (which are becoming scarce), is facilitated by aid from the state highway commission, which furnishes leadership, technical counsel of engineers on the commission's staff, and use of facilities of the state highway laboratory. This article gives digests of reports from nine counties, where the work involved mainly the construction of stabilized soil-aggregate bases and surfaces, and bituminous bases and wearing courses, using both plant-mix and road-mix methods. Approval of the cooperation has been almost universal. Traffic on the reconstructed roads has invariably increased. Lyon County sent gravel samples to the state laboratory for designing the mix for bituminous surfacing, and soil samples to determine maximum subgrade density, and borrowed an engineer from the state commission. For Kossuth County, the state laboratory made a design of mix to fit the materials available locally. Black Hawk County sent its assistant engineer to the state labora-

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NOTE: See page 59 this issue. Another "Scotchman" story about efficient Ice and Snow Control.

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tory for a two-weeks course in the inspection of materials, subgrade compaction, and the operation of the various pieces of equipment. Reports from most of the other counties mentioned aid by the state laboratory and state engineers.

"Iowa Counties Seek Improved Surfaces for Secondary Roads;" *Better Roads*, January.

Asphalt Emulsion For Improving Gravel Roads

Austin, Texas, after the war, found itself with 300 miles of rough, dusty gravel streets and thousands of angry citizens, but limited finances. Settling the dust, and keeping it settled, with water was found to be impractical. A solution was found by adding asphalt emulsion to the water distributed by sprinkling trucks. Trial was made by mixing 200 gal. of emulsified asphalt with 800 gal. of water. This proved to be too much asphalt, and the dose finally adopted was 75 gal. of emulsion to 925 gal. of water, then a few days later 50 gal. per truck, followed a week or 10 days later with a third application of 50 gal. The streets were first bladed, rolled and watered until a smooth surface was obtained. Usually it was necessary to repeat the sprinkling only about once a month. The cost of this, additional to that of the previous sprinkling with water alone, is about 4¢ per sq. yd. While this is nothing more than a stop-gap measure until paving can be done, it prevents dust, saves blading costs, and some streets, after a few treatments, look enough like penetration pavement to fool many people.

Noble E. Latson—"Dust Laying Problem:" *Roads and Streets*, January.

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New Jersey Turnpike. By *Paul L. Troast*, Chairman, N. J. Turnpike Authority; *W. W. Hannamaker*, Exec. Dir.; *Enoch K. Needles*, Cons. Engr.; *George W. Burpee*, Cons. Engr.; *Chas. M. Noble*, Chf. Engr.; *O. J. Porter*, Cons. Engr.; *L. C. Urquehart*, Cons. Engr; *J. D. Welch*, Soils Engr.; *O. H. Ammann*, Cons. Engr.; *Ellis L. Paul*, Cons. Engr.; *John R. Dietz*, Cons. Engr.; *Leslie M. Stewart*, Bit. Consultant; *Carl H. Peterson, Jr.*, Project Engr.; *Stanton C. Funk*, Constr. Engr.; *W. W. Blauvelt*, Contractor; *Roland A. Wank*, Architect.

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Soil Stabilization with Cement. By *W. P. Andrews*. Jan. 2, Pp. 25-27.

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The Effect of Travel Time and Distance on Freeway Usage. By *Darel L. Truehlood*, Research Engr., B.P.R. February, Pp. 241-250.

Highway Subdrainage. By *E. S. Barber* and *C. L. Sawyer*, Engrs., B.P.R. February, Pp. 251-268.

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Surfacing Methods for Two Michigan Airports. By *L. C. Andrews*, Chf. Engr., Mich. Bd. of Aeronautics. February, P. 51.

Special Equipment Speeds Michigan Maintenance. By *Burleigh R. Downey*, Maint. Engr., State H'way Dept. February, Pp. 62-63, 101.

Machines and Men in Maintenance. By *M. W. Farber*, Maint. Engr., Wisconsin H'way Com'n. February, Pp. 64-65, 110.

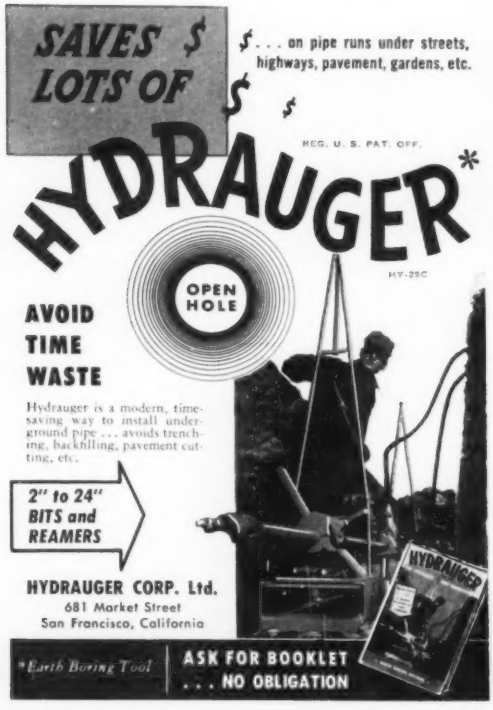
Grade Crossings Rated on Hazard to Traffic. February, P. 76.

Roads and Engineering Construction

Secondary-Road Surfacing Methods in Middlesex County, Ont. By *L. Michael Halliday*, Contractor. January, Pp. 63-67, 88.

New Equipment Speeds Up and Cuts Cost of Ice Control on Ontario Highways. January, Pp. 68-69, 105.

Design of Highway Drainage Structures Requires Knowledge of Hydraulics. By *Carl F. Izzard*, U. S. B.P.R. January, Pp. 78, 80, 82, 84, 97.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Work Planned for Phoenix

R. Gail Baker,
City Engineer, Phoenix, Ariz.

During the present year, the city engineering department of Phoenix will prepare plans for, and design and construct, public improvements, approximately as follows: Sky Harbor Airport improvements, $2,000,000, including additional runways, approach highways and new terminal buildings. Street paving, about 20 miles, varying in width from 30 ft. in residential districts to 60 ft. for main boulevards. Sanitary sewers, about 25 miles. Water mains, about 20 miles of 6-inch and larger, mostly in districts now served by small pipes, inadequate to meet the needs for water use and to furnish fire protection. This year we have changed from open dump firing for refuse disposal to the land fill method, using natural river bed sand and gravel for cover.

• • •

Most Valuable Equipment: A Truck-Mounted Backhoe

E. M. Potter,
Highway Commissioner, Douglas Co., Wisc.

During the summer of 1951, we added a $\frac{3}{8}$-yd. truck-mounted backhoe to our line of equipment. We have found this to be one of the most valuable pieces of equipment a highway department can own. Mobility and versatility are the outstanding features. We have used this machine continuously from the time it arrived, placing culverts, cleaning ditches and loading materials.

We used to place about one culvert a day by the old pick-and shovel method, using six laborers. Now, with a 3-man crew, we place two and sometimes three culverts a day. After floods, this machine is ideal for filling the scattered washouts throughout the county. We consider it one of the "musts" in our highway maintenance program.

• • •

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Lime Stabilization in Low-Cost Road Construction

The data presented here are from a paper by H. C. Carter, District Construction Engineer, Texas Highway Dep't., at the 50th meeting of the ARBA.

FROM the end of the war to the present, approximately 87 miles of roads have been treated with lime. The depth of treatment has ranged from 4 inches to 8 inches. The work has been performed by State forces as well as by contract. Both waste lime and commercial hydrated lime have been used. Width of stabilization has varied from 20 feet on farm-to-market roads to 60 feet on city streets. The following has been common to all the projects: 3% by weight of lime (based on the dry weight of base material) has been used and all the materials treated have been so called "inferior" base materials, that

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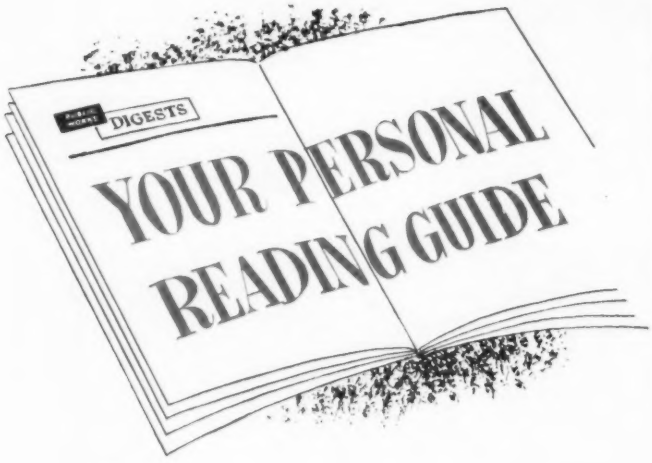

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is, materials containing aggregate and usually a plastic binder. The projects have been in areas where local fine or blow sand was not available. On most of the projects the materials have been mixed directly on the roadway and all mixing has been by blading. On some of the work within cities the materials have been pre-mixed and hauled to the street.

For the projects mixed directly on the roadway, the construction methods have been about the same. The gravel was normally dumped in the center of the road. The piles were evened by blading, leaving a trench or V in the center to hold the lime, since it will flow ahead of the blades. The windrow was then bladed back to the center to "wrap up" the lime. The material could be left in this position for short periods, even in wet weather, without apparent damage. The windrow was cut in half and each half bladed out to the crown line. The left windrow was then completely bladed across the road to the right again forming one windrow. The total was then bladed completely across the road to form one windrow on the left. One half was then carried back to the right and the material "laid in" by taking a cut from first one windrow and carrying it uniformly across the roadway and then a similar cut from the other windrow. The thoroughness of the mix can be detected by eye because of the whiteness of the lime. Finally, the remaining windrows were bladed to about $\frac{1}{4}$ points and the edges "laid in" in light lifts. Each lift was sprinkled and rolled as it was placed in its position.

The mixing for the city street work was performed by dumping the material in windrows on some available open area near the project. The lime was added and the material was mixed by blading in the manner as described above. After thoroughly mixing the material it was hauled to the jobs and bladed and sprinkled in light lifts. Sprinkling was controlled to insure a total moisture content of about Proctor optimum or just a little dryer. The completed base was then maintained in a damp condition by sprinkling for three to four days.

The base should be finished completely smooth and so maintained for two reasons: One, the hardened base is quite hard to cut. It requires large amounts of water and numerous grader blades. Second, the retempered top layer is not as durable as the original mixture.

The projects constructed in this District have been subjected to rains in almost every stage of the construction at one time or another with no apparent damage. A rain during the mixing period will normally require more blading to dry the material in order to complete the mixing.

Cost Data

The weight of materials in this District, containing aggregate, compacted in the roadway, will range from 3300 to 3500 pounds per cubic yard. If the average were 3333 pounds and 3% lime were used this would amount to 100 pounds, or 2 sacks or 1/20 ton, of lime per cubic yard compacted. The cost of lime, which includes furnishing, emptying and disposing of the sacks on contract work has ranged from $16 to $21 per ton, the average on five jobs being $18.80. The cost on State force account jobs has ranged from $17.15 to $21.33, the average of four jobs being $18.74. The cost of emptying and disposing of the sacks has been about $1.50 per ton on State force account jobs.

It requires approximately one hour of blading or mixing time for each 50 cubic yards of "inferior" base material. As mentioned above, the lime stabilized base should be damp cured. The cost of "inferior" base material, plus haul, blading, sprinkling and rolling can be determined for any given locality. To this amount should be added approximately $1.26 per cubic yard or $0.21 per square yard, 6" thick, to obtain the cost of lime stabilization.

Not all materials react with lime. Some show no reaction; some show varying hardening; others become very hard and durable. Preliminary laboratory study is necessary to determine the suitability of a material.

How Calcium Chloride Saves Road Money

This is a portion of a paper presented by J. T. Sharpensteen, County Highway Engineer, Flint, Mich., at the 50th ARBA meeting.

IT can be shown conclusively that road dollars are saved by using calcium chloride. Cost records will reflect savings in replacement gravel and in the cost of grading. A little understood saving is in the reduction of the cost of spring breakups due to deep frost penetration. Research has shown that 85% of the calcium chloride used on a road remains somewhere in the road and has been found as much as nine feet below on the average road; however, most of the chemical remains in the top two feet of the road's surface where protection is needed most. Calcium chloride lowers the freezing point, hence the depth of frost penetration will vary inversely with the amount of calcium chloride applied to the road. Especially bad breakups recurring yearly have been completely stopped by boring holes to a depth of three or four feet and filling with calcium chloride. Just how often such treatments will have to be repeated to prevent bad spots from breaking up again in the spring has not been determined because none of the places so treated have yet required further attention although some have gone for 12 to 14 years.

Data on Gravel Loss

There has been some research on gravel road wear but results are not in agreement on the annual loss

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of material. Prof. Swinton of the University of Michigan established by investigation that ordinary 18-foot untreated gravel roads, carrying an average daily traffic of 395 vehicles, have an annual loss of 244 cubic yards per mile, or ¾ inch in depth. The Bureau of Public Roads has determined that the average annual wear on gravel roads throughout the United States is ½ inch. Other investigators have shown that the loss of material can be reduced at least 80% by the use of calcium chloride and grading costs will be reduced as much as 85%. The writer has information on a case involving an 18-foot gravel road about 1½ miles in length, carrying an average daily traffic of 3,500 vehicles. This requires an annual gravel replacement of 2 inches or 586 cubic yards per mile at a cost of $2.50 per cubic yard amounting to $1,486. When the resurfacing gravel is placed, soil binder is added and thoroughly mixed with the new gravel. Water is then added along with 1.2 pounds of calcium chloride per square yard. About the middle of the season it is necessary to scarify and remix the top two inches and add another 1.2 pounds of calcium chloride per square yard. In all, 5.4 pounds per square yard is used per mile in one season. Grading is done only after heavy rains and immediately before an application of calcium chloride. Applying the rate of wear for untreated gravel roads previously mentioned, it can be shown that the annual loss for this road would be 2940 cubic yards of gravel per mile per year if maintained as an untreated gravel road. Applying Prof. Swinton's figure of 71.8 cubic yards loss per mile per year for 100 vehicles, a total loss per mile per year would be 2513 cubic yards.

Amount of Savings

Net savings on maintenance costs have averaged $168 per mile, with savings of $152 and $185 per mile on primary roads and local roads respectively. It should be borne in mind that these savings do not take into consideration the saving from the reduction of the loss of gravel, but represent only the lesser cost of machine maintenance.

With nearly all the primary mileage carrying in excess of 500 vehicles a day it is safe to assume that the annual gravel loss on the primary roads amounted to at least ¾ inch or 220 cubic yards per mile under dry maintenance and, by assuming an 80% reduction in the loss of gravel by using calcium chloride, it can be shown that 176 cubic yards of gravel per mile was saved. It costs $2.50 per cubic yard for gravel on the road in this county which means a saving of $440 per mile for gravel alone, or an aggregate gross saving, including maintenance, of $625 per mile for primary roads. In like manner, for local roads, assuming a reduction of ½ inch in the loss of gravel, it can be shown that a saving of $292 per mile for gravel alone resulted and an aggregate gross saving of $444 per mile was accomplished.

The net saving resulting from using calcium chloride involves deducting the cost of the material from the gross saving previously given. Calcium chloride costs $32 per ton on the road in this county and an average of 12 tons per mile per year is used on primary roads costing $384. On local roads, 9 tons per mile is used at a cost of $288. Deducting the cost of calcium chloride from the gross savings previously mentioned, a net annual saving of $241 per mile for primary roads and $156 per mile for local roads results.

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Sulfur Joints In Cast Iron Mains

The number of alleged failures of pipe joined with sulfur cement is statistically insignificant. Experience and research data indicate that properly constructed joints using a rubber ring and sulfur compounds made in accordance with the Atlas formula will be essentially trouble-free. Sulfur cements should not be used in cast-iron pipe under conditions that are corrosive to cast iron itself, nor should they be used if the pH of the water or the surrounding soil is greater than 9. Sulfur, like lead, is attacked by alkalies, and although it is completely resistant to the strongest non-oxidizing acids, its use is not recommended with cast iron at pH values less than 4.

Raymond B. Seymour *et al* of Atlas Mineral Products Co.—"Performance Studies on Sulfur Jointing Compounds;" *Journal, American Water Works Ass'n*, December.

Photography in the Water Laboratory

The water works laboratory of South Pittsburgh finds macrophotography very useful. Four color slides can tell the complete story of a water meter that has seen long service—one of the interior of the main casing showing the type and amount of deposit or the color and extent of corrosion. Another of the interior of the bottom cap, showing the effectiveness of a liner or the need of one. A slide of the outside of the measuring chamber if sand rings are employed. And a slide of the inside of the measuring chamber and the disc to show the quantity of deposit or the color and type of pitting or etching. Also a slide of the gear train, showing type of driving cam, composition of the lower plate screws and the control block ring. "Before and after" slides will furnish proof of the effectiveness of various cleaning solutions. A close picture of a cross-section of pipe that is heavily encrusted will show the color and structure of the deposit and extent of damage. A visible proof of the true condition of the inside of a tank can be obtained with a 35 mm camera loaded with color film. The equipment used is a 35 mm, through-the-lens reflex camera with at least an f. 3.5 lens—as a Kine-Exacta II; portrait lenses #1, #2 and #3; and a stand with arm for two photo reflector flood lamps and another for the camera. Also a good exposure meter.

F. R. Perrin—"Photography in the Water Works Laboratory;" *Journal of Pennsylvania W. W. Operators Ass'n*, for 1951.

Plastic Pipe For Water Mains

Pax, W. Va., is believed to be the first community to use plastic pipe for water mains. The largest size used was 2-inch; 5% of the soil is solid rock and large boulders are numerous; but the plastic pipe can be "snaked" around the boulders. Also the soil is highly acid, which does not affect the plastic material. Being easily handled, the pipe can be installed more rapidly than the trenching machine can dig a trench 30 in. deep. The main lines are of asbestos cement, 6-in. and larger.

Dennis M. Leary—"A Plastic Pipe Water System;" *American City*, January, and *Water & Sewage Works*, January.

Vibratory Explosive For Improving Wells

The proper use of explosives is the least expensive method of restoring wells, requires the shortest shut-down time, and produces minimum disturbance to the pumping unit. But improper use of them can ruin a well. For the water industry, the vibratory explosive method possesses many advantages. It is safe, because formulas have been developed to calculate the explosive force which can be applied to the function desired. Small charges, accurately timed, clean the casing and surrounding formations; can be detonated anywhere within the casing, thus leaving the pump practically undisturbed; and complete cleaning is achieved by the sustained vibration. By combining small charges, accurately spaced and carefully timed to use the secondary effect of colliding shock waves and the ten washings of the gas bubble cycle, the equivalent energy of high explosives can be used safely.

Harvey A. Mylander—"Well Improvements by the Use of Vibratory Explosives;" *Journal, American Water Works Ass'n*, January.

Calculating Water Hammer

The author says that the idea many entertain that if a valve does not slam mechanically there will be no water hammer is erroneous. Also that some formulas for calculating hammer are good within limits, but most are dangerous to use. He then explains the surge-wave theory and short cuts possible by use of graphical methods. A few factors can be checked to indicate whether surges of serious proportions will occur in a given system. Such surges are likely to occur if any one of the following 7 conditions exist: 1—High spots on the profile of the transmission main, where a vacuum can be caused by a parting of the water column when a pump is cut off. 2—If the length of the transmission main is less than 20 times the head on the pump (both valves are expressed in feet). 3—If the maximum velocity of flow in the transmission main exceeds 4 fps. 4—If the factor of safety of the pipe is less than 3.5 for normal operating pressures. 5—If the column

comes to rest and reverses direction of flow in less than the critical surge wave time of the transmission main. 6—If the check valve closes in less than such critical time. 7—If there are any quick-closing automatic valves set to open or close in less than 5 seconds. If any two or more of these and five additional conditions occur, the probability of surges will be in proportion to the number of such conditions. The additional conditions are: 8—If the pump or its motor would be damaged if allowed to run backward up to full speed. 9—If the pump will be tripped off before the discharge valve is fully closed. 10—If the pump is started with the discharge gate valve open. 11—If there are booster stations on the system which are dependent on the operation of the main pumping station under consideration. 12—If there are any quick-closing automatic valves used in the pumping system that become inoperative with the failure of pumping system pressure.

S. Logan Kerr—"Water Hammer Control;" *Journal, American Water Works Ass'n*, December.

Desalting Saline Waters

Sea water throughout the world is practically constant in composition at about 3.5% total dissolved solids. The non-toxic neutral salts produce major physiological effects only when ingested materially above isotonic levels, which, for sodium chloride is 7,500 ppm. Concentrations of NaCL below 7,500, and of magnesium or sulfate below 1,000 gpm are believed to be harmless. Water containing such amounts would rarely be used even in an emergency. Waters containing concentrations of dissolved salts up to 2500 to 3500 can be used without adverse effects by those accustomed to them. There is a real need for an economical process that will reduce the salt content of saline waters to less than 500 ppm, or at least to 1,000 ppm, and eliminate any toxic ions. At present the only methods that approach economic feasibility are evaporation and ion-exchange demineralization. Possibly radically different methods may sometime be developed. Thermal evaporation in which fuel is burned to produce steam, which is re-condensed, is at present the most widely used method. The vapor compression evaporator is a notable advance in distillation technique. Solar evaporation has possibilities for remote areas where a small amount of water would be required and supplying fuel or chemicals would be a serious consideration. Removal of salts by ion exchange is unsuitable for water containing more than about 2,500 ppm of dissolved salts; but such limitation may be removed by new developments. Operating cost per thousand gallons of water produced by double-effect evaporation are usually quoted as $1.00 to $2.00; small single-effect evaporators may go as high as $4.00 to $6.00. Vapor-compression stills seem able to produce distilled water at about $1.00 to $1.25; as low as $0.50 for large units. Demineralization by ion-exchange in Israel is said to cost, in cents per 1,000 gal., for conventional demineralization, 23-28¢ for removing 500 ppm of salts, and 75-80¢ for removing 2,000 ppm; for partial demineralization with lime regeneration, 8-10¢ for 500 ppm and 22-24¢ for 2,000 ppm. Effluents from ion-exchange will retain much of the original bacterial content, color and turbidity, which are almost completely removed by distillation methods when properly operated.

Edward W. Moore—"The Desalting of Saline Waters;" *Journal, New England Water Works Ass'n.*, Dec.

Weismann Institute, in Israel, has been testing various methods of "desalinization" of brackish waters containing 1,280 to 2,000 ppm of total dissolved solids and higher. The pilot plant employing ion exchange contained a softening column with Dowex-30 as sulfonic acid exchanger and anion exchange columns containing Amberlite 1R-4B. To achieve maximum economy of sulfuric acid used for regeneration, the counter-current technique of partial regeneration of the hydrogen-ion exchangers was used. Acid and soda ash regenerant efficiencies were approximately 70% of the theoretical values and salt regenerant efficiency approximately 40%. The total dissolved salts were reduced from 1,500-2,000 to 500 ppm. Sodium sulfate was recovered from small batches of the spent hydrogen-ion exchange effluent by solar evaporation. The cost was estimated to be 60¢ per 1,000 gal. treated per 1,000 ppm solids (as NaCl) removed.

K. S. Spiegler, Walter Juda and Morris Carron—"Counterflow Regeneration of Cation Exchanger in Partial Demineralization of Brackish Waters;" *Journal, American Water Works Ass'n.*, January.

Hydroxyethyl Cellulose as a Coagulation Aid

Since 1931 activated silica has been adopted by many plants as an aid in coagulating difficult waters. However, activated silica solutions are difficult to prepare and must be aged before use. The author presents the advantages of Hydroxyethyl cellulose (HEC). Plant usage shows that as little as 1 ppm is very effective; this is easily prepared by reacting ethylene oxide or ethylene chlorohydrin with alkali cellulose. In use, HEC, a dry fluffy solid, is slurried in water to a strength of about 10%, which slurry is run into a tank holding a 4" solution of caustic soda. The cost of this material is low in the low dosages (1 ppm or less) required. Unskilled operators may be used. It guards against carryover of turbidity from settling basins when handling surface supplies of fluctuating quality. It extends water treatment capacity with existing equipment; and reduces by-product sulfates in amounts equivalent to the alum reduction.

F. N. Kemmer, C. B. Houser, R. E. Steeper and B. W. Dickerson—"New Coagulant Aid;" *Water & Sewage Works*, January.

Municipal Liability in Fluoridation

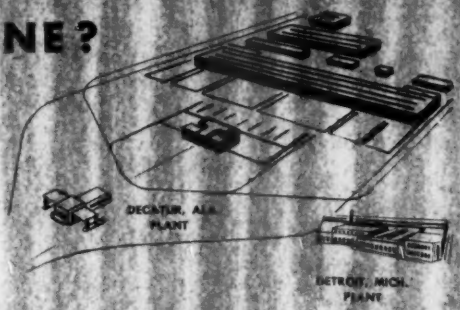
The liability of a city in suits for damages from the use of fluoride in city waters has not been specifically adjudicated. Although in the law the operation of a water system by a municipality is a proprietary function, a damage which was proximately occasioned by negligence must be established. To recover, an individual would have to show that he suffered an injury because of the negligent use of fluoride. All of these questions are within the province of a jury with proper instructions from the court. Any attempt to prove liability upon the part of the city because of the fluoridation process would, in the author's opinion, be a somewhat difficult task.

Burnell Waldrep—"Municipal Liability in Damage Suits from Fluoridation;" *Journal, American Water Works Ass'n.*, January.

Geophysical Ground Water Surveys

The cost of geophysical exploration varies from $300 to $600 a day, depending upon the extent of the

WHO IS WOLVERINE?



The name, Wolverine, identifies a seamless, nonferrous tubing made by one of the country's leading tube manufacturers, whose full name is Wolverine Tube Division of the Calumet & Hecla Consolidated Copper Company, Inc.

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The outstanding quality of this product—constantly and rigidly controlled from ore to finished product—has won preference among a wide variety of users found in the fields of refrigeration, plumbing and heating, air-conditioning, processing, liquid-petroleum gas, and others.

In addition to the plant at Detroit, Wolverine has a plant at Decatur, Alabama, which is said to be the most modern tube plant in the world. It covers 265 acres of land.

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area to be surveyed, amount and type of personnel necessary, availability of the site, and depth beneath the surface to which information must be derived. The money spent on this, however, is far less than that spent in haphazard procurement of information by other slower methods. — J. Frederick Stickel, Jr.

The electric resistivity method is currently most suitable for reconnaissance and, usually, verification of the results must be obtained by means of geologic mapping and soil borings. It is necessary to obtain samples to identify the various soils positively and to evaluate soil strength.

Bernard B. Gordon—"Geophysics and Water;" *Journal, American Water Works Ass'n*, January.

Study of Distribution Systems By Electric Circuits

In using an electric circuit to represent a pipe line network, the relation between voltage across and current through each resistor must be similar to the relation between head loss along and flow rate through the pipe line it represents. Since this relation is nonlinear, an ordinary linear resistor cannot automatically provide a complete analogy to the performance of a pipe line, and a successive-approximation procedure must be employed. The author describes the use of nonlinear resistors which have the characteristic of the equation $V = kI^{1.85}$. These are composed of tungsten filaments supported on heavy nickel leads in evacuated glass bulbs; the voltage along the filaments varies very nearly as the 1.63 power of current through them. This can be raised to the desired value of 1.85 by utilizing the cooling effect of the leads; and for each standard filament diameter, a certain range of values of k may be realized. A resistor can be obtained the coefficient of which has a value within approximately $\pm 2.5\%$ of any desired value. Adjustable rheostats in series with constant-current ballast lamps are used, and an equipment called a pipeline network analyzer (developed at Cornell University). By the procedure described in detail by the author, overall errors in head-loss indications have always been less than 3%. Solutions of network problems are direct, requiring no successive approximations. Results are given directly in hydraulic units and automatically balance.

Malcolm S. McIlroy—"Water Distribution Systems Studied by a Complete Electrical Analogy;" *Journal, New England Water Works Ass'n*, December.

Molecular Filters For Bacteriological Analyses

The California Institute of Technology has developed a method of producing and using a number of types of molecular filter membranes, one of which is designed especially to fulfill the requirements of standard methods of water bacteriology. The advantages of molecular filter techniques over the present standard methods of bacterial analysis are so numerous and so distinct that this method may give entirely new aspects to the field of water bacteriology. The membranes used for these filters are circular disks 50 mm in diameter, composed of a mixture of cellulose esters which form a submicroscopic sponge-like structure of very uniform interstitial dimensions; the pore size is much wider on the emerging side

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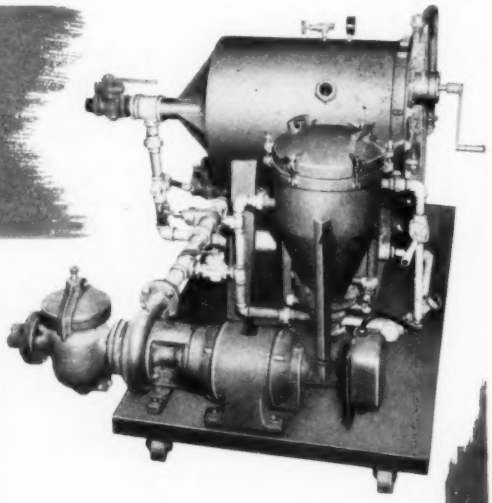

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Complete units, including filter, pump, slurry feeder, debris catcher, chlorinator, and gasoline engine can be furnished ready for mounting on truck or trailer bed. Filters are available with rated capacities ranging from 900 GPH to 72,000 GPH. These standard sizes, however, can deliver far greater quantities of water when necessary, although this is not recommended for general service. Write for literature.

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of the filter than on the entering side; there are about 500,000 pore openings in the area used for filtration. The film is about 6 mm thick. Water is sucked through the filter by means of a vacuum pump, leaving the microorganisms on the surface of the filter disk. This disk is then placed on the surface of a liquid or semiliquid nutrient, which diffuses through the pores of the disk to the microorganisms on the upper surface.

The molecular filter permits the concentration of a small number of organisms from large quantities of water; minimizes cross-diffusion and spreading of colonies; permits separation of the organisms from their nutrient at any time; gives a direct count instead of a most probable number in determining lactose-fermenting bacteria; saves time; requires much less laboratory space and glassware; permits better and faster differentiation of bacteria; and gives a permanent record in the form of the preserved filter disks.

Alexander Goetz and Noel Tsuneishi—"Application of Molecular Filter Membranes to the Bacteriological Analysis of Water;" *Journal, American Water Works Ass'n.*, December.

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Safety in Water Departments. By *Lynn Erratt*, Safety Advisor, Bd. of Water & Light Com'rs, Lansing, Mich. January, Pp. 15-17.

Geophysics and Water. By *J. Frederick Stickel, Jr.* and *Loren E. Blakeley*, Cons. Engrs., and Bernard B. Gordon, Civ. Engr., East Bay Mun. Utility Dist. January, Pp. 23-35.

Preliminary Studies of Underground Water at Wausau, Wis. By *Howard P. Potter*, Cons. Engr. January, Pp. 36-38.

Well Improvement by the Use of Vibratory Explosives. By *Harvey A. Mylander*, Dist. Engr., Water Supply Analysts. January, Pp. 39-48.

Stability and Activity of Activated Silica Sols. By *Clarence R. Henry*, Chf. Chemist, Miami Fla., Dept. of Water & Sewers. January, Pp. 49-57.

Valve Maintenance and Repair Program at Peterborough, Ont. By *Ross L. Dobbin*, Gen. Mgr., Utilities Com'n. January, Pp. 58-60.

Flural—A New Flocculating-Fluoridating Agent. By *Wayne E. White* and *Jack C. Gillespie*, Ozark-Mahoning Co., and *Otto M. Smith*, Okla. Agri. & Mechanical College. January, Pp. 71-79.

Counterflow Regeneration of Cation Exchanger in Partial Demineralization of Brackish Waters. By *K. S. Spiegler, Walter Juda* and *Morris Carron*, Weizmann Inst. of Science, Israel. January, Pp. 80-88.

New England Water Works Ass'n. Journal

Water-Distribution Systems Studied by a Complete Electrical Analogy. By *Malcolm S. McIlroy*, Prof. of Electrical Engr., Cornell Univ. December, Pp. 299-317.

The Desalting of Saline Waters; A Review of the Present Status. By *Edward W. Moore*, Assoc. Prof. of San Chem., Harvard Univ. December, Pp. 319-337.

Pennsylvania Water Works Operators Ass'n. Journal

Photography in the Water Works Laboratory. By *F. R. Perrin*, Chemist, So. Pittsburgh Water Co. Year of 1951, Pp. 82-84.

Water Well Maintenance. By *J. B. Murphy*, Engr., Am. W. W. Service Co. Year of 1951, Pp. 94-106.

Water Supplies and Atomic Bombing. By *Geo. W. Moore*, San. Engr. N. Y. Dept. of Health. Year of 1951, Pp. 112-117.

Suspended Solids Contact Reactors. By *Robert W. Haywood, Jr.*, E. I. du Pont de Nemours & Co. Year of 1951, Pp. 127-135.

Public Works

How Chlorination Improves Swimming Pool Operation. By *A. E. Griffin* and *Harold Landshof*, Wallace & Tiernan Co. February, Pp. 58-61, 93.

What You Should Know About Engines for Standby Service. By *E. D. West*, Climax Engine & Pump Mfg. Co. February, Pp. 69-71, 112.

Water and Sewage Works

Pipe Cutting Experiences with the Improved Wachs Pipe Saw. By *Dan W. Anglin*, Supt. Water Pipe Extension Div., Chicago, Ill. January, Pp. 14-15.

A New Coagulation Aid (Hydroxethyl Cellulose). By *F. N. Kemmer* and *C. B. Houser*, Cochrane Corp., and *R. E. Steeper* and *B. W. Dickerson*, Hercules Powder Co. January, Pp. 16-19.

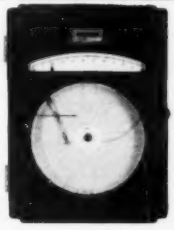
Basic Factors in Centrifugal Pump Application. By *Roy Carter* and *Igor J. Karassik*, Worthington Pump & Mach'y Corp. January, Pp. 20-23.

Water Works Engineering

Preventing Electrochemical Corrosion in Sea Water. By *B. M. Duncan*, Asst. Supt., Dept. of Pub. Wks., Tampa, Fla., and *Carl J. Lamb*, Marine Consultant, February, Pp. 126, 150.

Misuse of Watershed Caused Pollution at Concord, N. H. By *Arthur G. Faneuf*, W. W. Supt., and *Wm. A. Healy*, Dir. of San. Eng. February, Pp. 131, 153.

Iron Removal Plant for Small Wisconsin City. By *John E. Habel*, February, P. 132.



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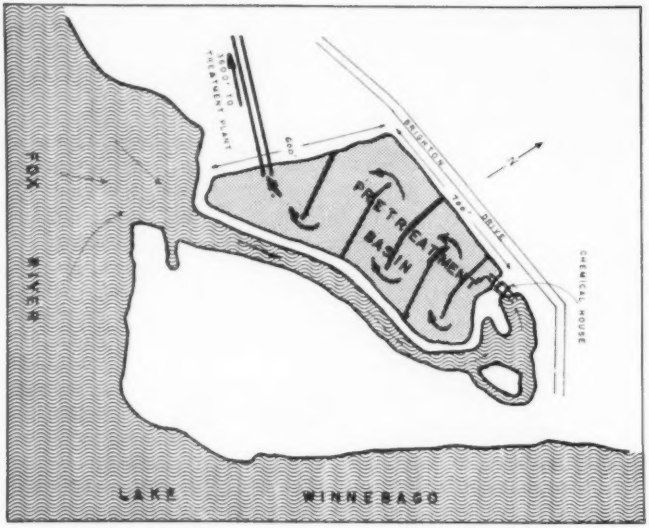

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Solving a Serious Algae-Odor Problem

LAKE Winnebago is the source of water supply for Menasha, Oskosh, Neenah and Appleton, Wisc. It is 30 miles long and 10 miles wide; the maximum depth is only 21 feet and summer temperatures of the water range from 70° to 92°. It is fed by streams which drain thousands of acres of farmland and are high in nitrates and phosphates. It naturally follows that there are severe periodic growths of algae from late spring until early fall. In August, 1939, for example, water temperature was 85°, algae count reached 50,000 units per ml., turbidity 200 ppm. and odor 300. Treatment with 100 ppm. of carbon and 9 grains of alum reduced the odor to about 15 and the turbidity to 10, which was far from satisfactory. Various types of plants, coagulants and odor-removing materials were tried by the cities using this water, but with little success. It was impracticable to use copper sulphate in a lake of this size, but the idea was suggested by creating an artificial lake of a size practicable for copper sulphate treatment.

Experiments indicated that if the water could stand in open sunlight for 3 to 7 days after treatment, the algae would be destroyed. A swamp about a half-mile from the water treatment plant, and connected with the lake through a channel about 1,000 ft. long and 50 ft. wide, was excavated to form a basin, roughly triangular in shape with sides 1,000 ft., 700 ft. and 700 ft. long respectively and 7 ft. deep. Five cement baffle walls, alternating from side to side, compels the water to follow a circuitous route and give a retention in the basin of 7 or 8 days. At the entrance end is a chemical feed house where copper sulphate is applied at the rate of 2 ppm continuously throughout the algae season. This kills all the algae, which rise to the surface. Near this end of the basin the odors are very high; but the algae rapidly are disintegrated or decomposed (they do not settle to the bottom) and by the time the water reaches the middle of the basin there is only a yellow oily scum on the surface; and this has disappeared by the time the outlet of the basin is reached. During the algae season of 1949, the water entered the basin with an odor of 20 to 100, which was reduced in the basin to 10 to 25, and this was reduced by chlorination to an average of below 5, and activated carbon easily produced a satisfactory water. During June 1st to September 30th, 1949, Menasha used 13,000 pounds of carbon, which is only one-fifth of the amount that would have been required without the basin pretreatment, and only about 15% as high a dosage rate used during the same period by the other three cities using this lake water. These data are from a paper in *Taste and Odor Control Journal* by Andrew J. Marx, Water Plant Engineer, Menasha, Wisconsin.

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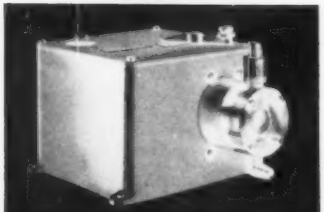

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How Aeration Tank Foaming Troubles were Conquered

S. L. Allison,
Sup't., Sewer Division,
Corpus Christi, Tex.

WTH the advent of detergents and other foam and suds producers, Corpus Christi's southside sewage treatment plant, a small diffused air activated sludge plant handling strictly domestic sewage, started having foam troubles. Foaming increased until it became a real problem, killing grass and shrubs, creating an unsightly mess and upsetting plant performance by cutting down oxygen absorption from the air.

Our plant had a low-head 200-gpm pump which had been used to pump effluent to a nearby golf course. A 2½-in. galvanized iron pipe was laid along the wall of the aerator and at 3-ft. intervals half-inch copper tubing 12 ins. long was brazed into drilled holes. At first, the ends of the tubing were flattened and lipped to produce various types of sprays, but finally the flattened end was closed and a hack saw was used to cut a slot three-sixteenths of an inch deep half an inch from the end. This produced a spray that shot straight down a few inches from the wall where the rollover caused the foam to build up. This proved best and the sprays are shielded from the wind. An old hacksaw blade drawn through the slot occasionally clears any clogging that may occur. We have also had satisfactory results by cutting out half of the cross section of the tubing for about three-quarters of an inch, bending the upper part down, inserting a strip of sheet metal over the end of the pipe and hammering the bent lip until a satisfactory fan spray is formed.

As effluent is used for the sprays, the quantity of water used is not too important and water conservation has not been attempted. However, sprays can be made and rigged to use almost any given amount of water. In any case, the spacing of the sprays should be such as to allow all sprays to lap.

Our water sprays can be used all year as we seldom have freezing weather. However, air sprays will break down foam if turned against the wall where the foam accumulates and so that the air will not blow the foam away.

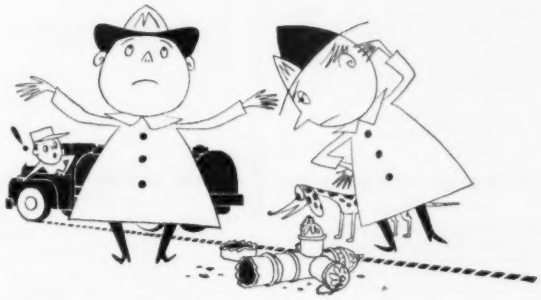
On a number of occasions, water jets on a 75° angle to set up a rotating action have been used to control a foaming digester. Rotation was started with a nozzled stream from a 1½-inch fire hose and then maintained by the jets.

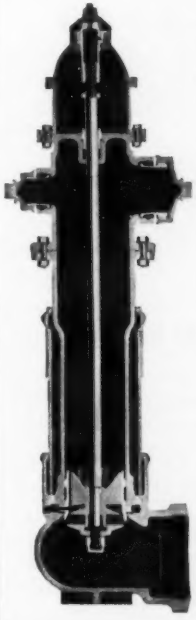
Water jets or spray impingement is one of the best ways to break down foam. The main problem is to bring the foam to the spray or to cover the foam with the spray. Stationary jets will cut a hole in the foam, if both jet and foam are stationary; therefore, the foam must move into the sprays or the spray must move over the foam.

Spray control for foam pays off here. The operating cost is 2.7 cents per hour for power. Cleaning of the sprays is not counted as it is a part of the operator's routine. Installation costs will vary, of course. We used an existing pump and second hand pipe. We purchased only 100 ft. of half-inch tubing and all work was done by department workmen.

Mr. Ehlers reports from California that, at some plants, foam is blowing as far as two miles. Sprays have licked our troubles with foam; wish our financial troubles could be licked as easily. We now have 100% overload, but you hear that everywhere you go, so no use crying about it.

Broken hydrant cannot leak!





The main valve opens against water pressure and closes with it. This is foolproof protection against flooding when hydrants are broken in traffic accidents.

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Sewage Treatment in North Dakota

Of the 114 sewerage systems in North Dakota, according to W. Van Heuvelen, director of the Division of Stream Pollution Control, 89 provide some type or degree of sewage treatment. There are 66 plants providing recognized primary treatment, and 16 of these also provide secondary treatment. In addition there are 7 installations utilizing lagoons satisfactorily.

About 61% of the 89 plants have adequate capacity for present loadings, but the other 35 plants need to be enlarged, reconstructed or operated more efficiently. At this time 41 new plants are needed.

These data are based on a 1950 survey and are reported in the Official Bulletin of the N. D. Water and Sewage Works Conference.

• • •

The New Worker

(*Continued from page* 49)

employees. The man who knows that the extra effort he puts forth toward doing a better job will be rewarded with promotion and that promotions are not made from outside of the department unless necessary, will get off on the right foot.

One of the most prevalent causes of dissent among new workers has been either a lack of understanding of the factors involved in his relations with the department and its executives or a lack of enthusiasm for his job.

Orientation such as that outlined in foregoing paragraphs will do much toward eliminating the first named cause. Initial enthusiasm for his job can be inspired by a clear cut policy on promotions, transfers, layoffs, demotions, etc., with a definite understanding that his advancement to a better job depends entirely on his ability to make good at his present job and acquire the skills needed to merit his promotion.

It should also give him a clear understanding that just as diligence and enterprise will reward him with a better job in the department so also will the lack of these qualities result in speedy demotion or dismissal.

Part of the introduction of the new employee should be an effort by supervisory personnel toward determining the extent of the new individual's interest in the department where he is starting work. A discussion of the better jobs avail-

able within the department than that at which he is starting should hold promise of such rewards to be attained through his own efforts.

The individual's particular interest in such advancement and the specialties and skills he may have to handle better jobs in other branches of the department should also be ascertained at the time of his entry into the organization.

When such information is obtained the department head will always have available in his files lists of men within his department who have interest in and skills usable in other positions in the department which may become vacant in the future.

When the new employee evidences such interest it is also advisable to have a program worked out that he may follow in improving his knowledge of the department as a whole that he can acquire while working at his new job in fitting himself for such advancement within his own section or transfer to a better paying job in another branch of the department itself.

A mutual understanding of each other's problems is always of benefit to the department head and his new employee and the clearer cut that understanding is at the very start of their relationship the better employee will result and the more faith and confidence in the department will grow with that new employee's continued presence on the departmental payroll.

• • •

Portland Sewerage

(*Continued from page* 44)

the treatment plant. From the Venturi, the sewage passes through heavy and coarse bar screens, which are to be cleaned by hand. The fine screens, with 1-inch openings between the bars, are expected to remove the floating solids passing the first screens. These fine screens are Chain Belt, mechanically cleaned.

One of the features of the plant is the grinding of the screenings. These are handled in Chain Belt grinders and are returned to the sewage stream.

Grit is removed in four grit channels equipped with Jeffrey grit collectors and washers.

From the grit channels the sewage passes into mechanically cleaned settling tanks equipped with Chain Belt collectors. These tanks are 225 ft. long, divided into 12 bays each 18 ft wide. Settling for 1½ hours is

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expected to remove 60% of the suspended solids.

Separate sludge digestion is provided in four tanks 90 ft. in diameter, three with floating covers and one which will be used as a gasholder. The sludge will be pumped by pneumatic ejectors to a preheating tank, from which the heated raw sludge will be pumped in the same manner to the digesters. Each of the four digesters may be operated as a primary or secondary unit. Presently, it is planned to use three units as primary tanks, and one as a secondary. All digesters are equipped with devices to permit continual or intermittent withdrawal of supernatant liquor. The digested sludge will be returned to the effluent for discharge through the outfall sewer to the Columbia River.

Outfall Sewer

The outfall line is siphoned under the Columbia Slough for 450 ft. and under the Oregon Slough for 1500 ft. to reach the Columbia River. The siphons are 18 ft. under ground. In the original design the outfall sewer was to be 8 ft. in diameter, with a round cross-section, but the contractor proposed that because he had the forms for the 102-in. horseshoe-shaped interceptor, he could build the outfall line more economically with these forms. This was permitted.

Two lines of concrete pipe are used for the siphons under the sloughs, one 54-in. and the other 72-in. At each end there is a precast concrete elbow turning upward from the level line under the slough, and at the upper end a special reinforced housing is cast to connect the two siphon lines to the semi-elliptical cross-section. All of the under-water pipe was placed in trenches by divers.

Two consulting engineering firms in Portland designed the system. Stevens and Koon had the sewer system, and John W. Cunningham and Associates designed the treatment plant. The heads of both concerns are members of the Board of Engineers for the project.

Wm. A. Bowes, Commissioner of Public Works, has had responsible charge of the entire project. Technical supervision is under L. G. Apperson, City Engineer. Contractors included: Geo. W. Lind; W. S. Smith, Inc.; Guy F. Atkinson Co.; Manson Const. Co.; L. F. Hoffman; Peter Kiewit Sons Co.; General Construction Co.; Kuckenberg Construction Co.; P. S. Ford; Henshaw Bros.; and Packard Pipe and Pump Co.

Public Works EQUIPMENT NEWS

Four Wheel Drive Tractor Shovel with 1-Yd. Bucket

The use of large peumatic tires, the same size all around, gives this new Hough Payloader tractor-shovel special traction and flotation for working in sand, mud and snow. There are four speeds in both directions. Control is hydraulic. The bucket is 1-yard, and the power unit is a 60-hp diesel or a 54-hp gasoline engine. It is designed to dig; load trucks and other vehicles; spread, level, strip, skim, carry and bulldoze; to handle materials; and plow and load snow. Data from F. G. Hough Co., 867 Seventh St., Libertyville, Ill., or use the coupon.

One-yard bucket Payloader.

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Phenolic Coating Resin Resists Corrosion

Corrosion of steel and concrete by acids or alkalis, or by any combination of these, is prevented by use of Phenoline 300, according to the manufacturer. Application can be made by brush, spray or trowel, without involving baking. This material will bond to almost any surface. It is resistant to most solvents and organic compounds, and to heat. Data from Carboline Co., 112 E 23rd St., New York 10, or use the coupon.

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Recording Speedometer for Wheeled Tractors

Calibrated from 1 to 10 mph, this recording speedometer is valuable for those tractor operations that require accurate recording of both speed and number of miles traveled. The unit includes a clock, a travel wheel and mounting brackets; it is quickly attached to the smooth portion of any tractor front wheel tire. Registration is within 2%. Frank Manufacturing Co., Mentone, Ind., or use the coupon.

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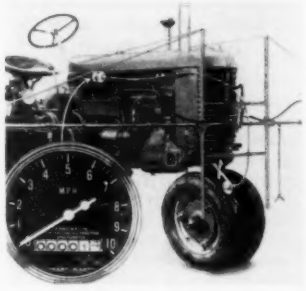

Records tractor speeds.

Electron Microscope Gives Up to 60,000X

The screen magnification of this electron microscope is continuous from 1,000 to 60,000 X, and the instrument is capable of producing micrograms of 30 Angstroms resolution or better. A beam oscillator permits rapid determination of focus; 35 mm film is used; built-in photometer insures proper exposure. Data from Research & Control Instr., 750 S. Fulton Ave., Mt. Vernon, N. Y., or use the coupon.

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A Completely New Line of Contractors' Pumps

An entirely new line of self-priming centrifugal pumps has been introduced by Marlow. These bear no outside resemblance to former models. They are available in size up to 240,000 gals. per hour, including all AGC standard sizes, plus several additional sizes. Special high-pressure models are available for water supply and for jetting. Pumps can be changed from base mounted to steel wheels or to pneumatic tires. In addition to gasoline engines, units can be equipped with kerosene or diesel engines. It is claimed that impeller designs have been so improved that full AGC ratings are obtained with moderate engine speeds. Construction is simple and assembly and dissembly is exceptionally easy. It is stated that only two parts, the impeller and the diffuser can wear and reduce pump efficiency and both of these are easily replaceable. Suction lifts to 25 ft. are guaranteed. Complete data from Marlow Pumps, Ridgewood, N. J., or use the coupon.

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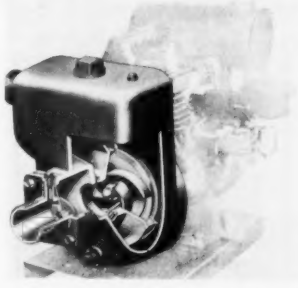

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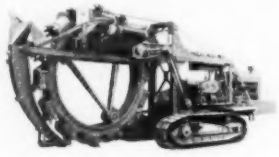
Can do many jobs.

Trenchers for Drainage and for Utility Trenching

The Model 202 Parsons wheel-type trencher is designed primarily for drainage and utility trenching. Bearing pressure is 5 to 6 psi, an important factor in drainage work. There are 30 separate feeds, 6.2 ins. to 18.5 fpm. It cuts, from 13 to 31 ins. wide, and up to 6 feet deep. The Model 215 is designed for "mile-a-day" production on pipe line work in the country. There are 6 digging wheel speeds up to 11.2 fpm. Gas or diesel power is available on either unit. Specifications and information from Parsons Co., Newton, Ia., or by using the coupon.



New Parsons Trenchliner.

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Getting Elevation Data in One-Tenth the Time

Vertical control is provided by these altimeters in one-tenth the time required by spirit or trigonometric leveling and the accuracy meets requirements for many types of work. This altimeter is sensitive to a change of 1 foot in elevation. There are three basic types, each of which can be calibrated for various working ranges. Full data from Wallace & Tiernan Co., Newark 1, N. J., or use the coupon.

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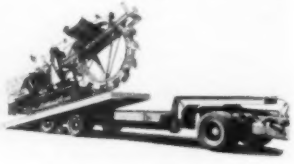
To get elevations quickly.

This Moves Your Labor-Saving Equipment Easily

A trailer that can be loaded or unloaded in 5 minutes by one man (so says the manufacturer) has been announced by La Crosse for moving heavy equipment, as trenchers or tractors. It is of the gooseneck type with tilting platform. It is available in 14, 18 and 22-ton capacity. The platform, which is 98 ins. wide, locks automatically into horizontal position. There are eight 15-inch tires; brakes are air or vacuum. Skids or blocking are not needed for the one-man unloading. Data from LaCrosse Trailer Corp., La Crosse, Wisc., or use coupon.



Trailer tilted for loading.

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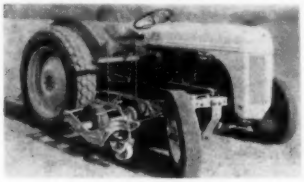
Wheel-Drive Mower for Tough Cutting Jobs

This is a heavy-duty rear wheel drive mower developed for large-area work. The rear rubber-drive wheels mow such areas 2 to 4 times faster than previous models. There are no sidewheels, resulting in less overall width, permitting closer mowing around obstacles and ability to work in restricted areas. An attachment for mowing high grass is available. Overhang of curbs is possible, eliminating unsightly fringes and costly hand mowing. Literature is available from Roseman Mower Corp., Evanston, Ill., or by using the coupon below.



Mows large areas rapidly.

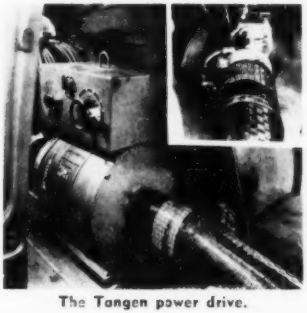
Use coupon on page 26; circle No. 3 - 10

Organic Disposal— "Garbage Into Gold"

This composting process is claimed to convert such organic wastes as garbage into an end-product which is a balanced plant food and can readily be sold at a profit. Two or three months are required for the composting process. Transportation of all materials is by sealed tube conveyor systems, so that there is no exposure to the air or to vermin. The literature sent to us contains little specific information in regard to design, capacities required, or methods of operation. Data from American Composter Co., 4016 South Cedar St., Lansing, Mich., or by using the coupon.

Use coupon on page 26; circle No. 3 - 11

Potential composting plant.



The Tangen power drive.

Truck Power Take-off for Standard Trucks

The Tangen power drive is a power take-off unit that can be readily installed in standard trucks with standard transmission units. It is said to make available 97% of the engine power for auxiliary power purposes. Installation does not affect the standard driving mechanism, and power is available while the vehicle is in motion. Data from Mobile Power Inc., Detroit, Mich., or use the coupon.

Use coupon on page 26; circle No. 3 - 12

Better Compaction with Special Roller Face

A Buffalo-Springfield tandem roller with a Gardner roll was used by Baun Construction Co., Fresno, Calif., for compacting soil-cement base and plant mix surface. Higher compaction was reported for the base than was possible with conventional methods. The photo shows the roll which is interchangeable with a smooth-face roll. More data from Buffalo-Springfield Roller Co., Springfield, O., or by using coupon.

Use coupon on page 26; circle No. 3 - 13

Gives better compaction.

HERE'S HOW TO GET Scotts LAWN PERFECTION

Always specify Scotts LAWN CARE PRODUCTS, and have a maintenance man read our Lawn Care bulletin service . . . it's FREE! Scotts turf specialists and soil testing service are also at your disposal to help solve turf problems. Start now to improve turf areas by writing for our recommendations and prices. You'll also receive Lawn Care regularly . . . no obligation, of course.

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*Trade Mrks Reg. U.S. Pat. Off.

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Kokomo, Indiana

Please send FREE copy of "Planned Protection"—complete manual on property protection.

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Solving Drainage Problems on Six Pennsylvania Highways

Some 206,000 feet of Bosco 6-inch plain end perforated drainage pipe with special spring clips were used on six Pennsylvania highway jobs in late 1951 for both underdrainage and subgrade drainage. The spring clips simplify jointing operations, reduce installation costs, and make the lines more stable under backfilling. Included in the six jobs were: An 11-mile section of the Pennsylvania Turnpike, 30-E, between Oakmont and Beaver Falls, on which 45,000 ft. were used by Harrison Construction Co. On Section 29-A of the Turnpike, A. J. Balte Co. placed 35,000 ft. About 30,000 ft. were placed on another turnpike job by Frank Mashuda Constr. Co. Allegheny Asphalt and Paving Co. laid 36,000 ft. on State Route 19; Harrison Construction Co. used 30,000 ft. on relocation and widening of Route 51; and Black Top Constr. Co. used 30,000 ft. on Routes 51 and 71. Write Bowerston Shale Co., Bowerston, O.; or use the coupon for data.

Use coupon on page 26; circle No. 3 - 14

Using the spring-clip.

Metal Detecting Device Locates Most Anything

This new type metal detecting unit is designed to find near-surface metal objects, such as tools, pavement-covered manhole covers and valve boxes, keys, buried silverware, coins and treasure. It can be used for objects covered by soil, rock, concrete, asphalt, wood, snow, ice or water. It weighs 7 pounds, and operates on a small battery. Fisher Laboratory, Palo Alto, Calif., or use the coupon.

Use coupon on page 26; circle No. 3 - 15

Fisher metal detector.

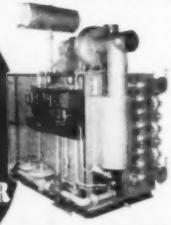
Stationary or Portable Gas Driven Arc Welder

You can get 1,000 combinations of welding current and open current voltage with this welder, according to the manufacturers. Power is by Chrysler industrial engine. The unit is weatherproofed. In addition to the welding current, 110-v, 1 kw capacity DC current is available for operating auxiliary tools. Lots of technical information on this is available from Hobart Bros., Troy, O., or by using the coupon below.

Use coupon on page 26; circle No. 3 - 16

TEMPERATURE CONTROLLED

P.F.T. DIGESTER HEATER AND HEAT EXCHANGER



P. F. T. Heaters provide close digester temperature controls, assuring highest possible gas production and digested sludge quality. Fired with sewage sludge gas or oil or a combination of fuels. Also utilize waste heat from engine jacket water. Write for Bulletin 135.

P.F.T. **PACIFIC FLUSH TANK CO.**

Waste Treatment Equipment Exclusively Since 1893

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write for our new 48 page Bulletin

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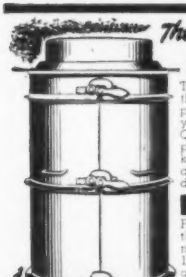

The **"Quinn Standard"** **FOR CONCRETE PIPE**

The Quinn Standard is known as the best the world over, wherever concrete pipe is produced and used. Backed by over 35 years' service in the hands of hundreds of Quinn-educated contractors, municipal departments and pipe manufacturers who know from experience that **Quinn pipe forms** and **Quinn mixing formulas** combine to produce the finest concrete pipe at lowest cost.

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For making pipe by hand methods by either the wet or semi-dry processes. Built to give more years of service—sizes for pipe from 10" up to 120" and larger—tongue and groove or bell end pipe at lowest cost.

WRITE TODAY. Complete information, prices, and estimates sent on request. Also manufacturers QUINN CONCRETE PIPE MACHINES.

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M-SCOPE PIPE — LOCATOR

Light Weight Model AB

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Metal Cased Cabinets
Superior Performance
at *Lower Cost*

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PALO ALTO CALIF.

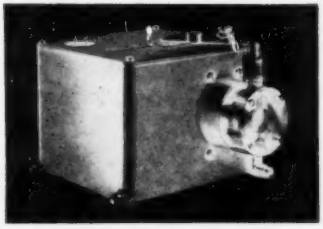
Non-Breakable, Long-Wear Traffic Markers

This is a traffic lane marker that can be put down on concrete, asphalt, or wood pavement surfaces. It is flexible and the advantages claimed for it are that it resists shock and breakage and provides long wear. They are available in white or in yellow. Installation is simple and quick. Fuller data from Traffic Safety Supply Co., N. E. Sandy Blvd. at 27th, Portland 12, Ore., or by using the coupon.

Use coupon on page 26; circle No. 3 - 17

For Fluoridation, Chlorination and Chemical Feeding

The Model S Precision feeder is of the positive displacement, diaphragm type, and will feed up to 60 gallons of solution in 24 hours. With



The Precision feeder.

a 5% solution, it can apply 1 ppm of chlorine to 3 mgd of water daily. It is able to apply a dosage of 1 ppm of fluoride to 1 mgd of water, using a 4% sodium fluoride solution. Ask for Bulletin PM 20, Precision Machine Co., 5 Union Square, Somerville 43, Mass., or use the coupon as indicated below.

Use coupon on page 26; circle No. 3 - 18

A Fork-Lift for the Moto-Bug Power Unit

A 5-ft. power driven fork lift attachment is now available for the Moto-Bug. This has a capacity rating of 1000 pounds at 15-inch load center. The full unit can climb a 12% grade with full load and has a 61-inch turning radius. Alternate attachments include a 10-cu. ft. hopper body, a 5-ft. scraper blade and a flatbed platform. Literature from Kwik-Mix Co., Port Washington, Wisc., or by using the coupon.

Use coupon on page 26; circle No. 3 - 19

You Can Expect These Advantages With

TENNESSEE CORPORATION Ferri-Floc FERRIC SULPHATE

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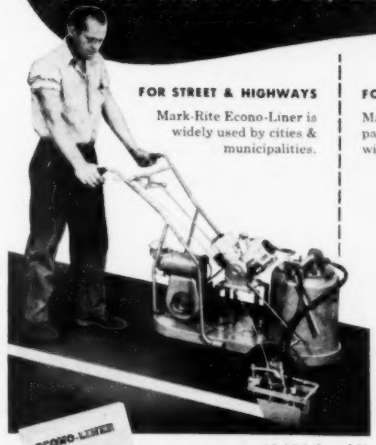

FOR STREET & HIGHWAYS

Mark-Rite Econo-Liner is widely used by cities & municipalities.

FOR PARKING AREAS

Mark-Rite Gravity Marker paints lines 2", 3" or 4" wide. 1½ gal. tank.

Mark guide lines quickly and clearly on streets, highways, parking and recreational areas. Econo-Liner is compact, durable, easy to operate and maintain. Adjustable shields produce sharp lines in any width from 2" to 6". Puts down approximately 10,000 to 15,000 ft. of line per hour. Has a 5 gal. cap. tank. Free-floating paint shields follow the contours on brick, black top, concrete or any other surface. Econo-Liner is easily converted into a portable spray rig. Dealers everywhere.

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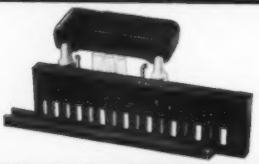
Mark-Rite LINE MARKERS

GUARANTEED pH & CHLORINE COLOR STANDARDS



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Gives theory and application of pH and chlorine control, illustrates and describes all Taylor sets. Write for your copy today.

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STOP WATER SEEPAGE SEWAGE CORROSION

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a clear liquid penetrating (1"+) sealer for concrete and masonry preventing water absorption and reducing the action of acids. Holds 12' hydrostatic head. Use our Hayproc Rubberized Enamel for color on walls and floors—not affected by concentrated acids, alcohol, oil, or traffic abrasion.

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MAIN SALES OFFICE 50 CHURCH ST., N. Y. C.

General offices and works W. Medford Sta., Boston, Mass.

PERSONAL NEWS

Charles L. Crangle, for several years Director of State Planning for Tennessee, in which position he has done a remarkably fine job, is now Executive Assistant of the Philadelphia City Planning Commission.

Axel O. Olson, formerly chief engineer of the San Francisco City-County Public Utilities Commission, has joined De Leuw, Cather & Co., consulting engineers of Chicago, Ill., and will be Western Manager with offices at 79 McAllister St., San Francisco.

Stevens & Thompson Engineers, 600 National Bldg., Portland, is the new name of the former firm of Stevens & Koon. Mr. Koon has retired from the partnership and Charles V. Foulds, Frank T. Koehler and Marvin W. Runyan have been made associates of the firm which is now composed of J. C. Stevens and H. L. Thompson.

ASSOCIATIONS

Indiana Section, AWWA, will hold its 44th annual meeting at the Lincoln Hotel, Indianapolis, Feb. 13 to 15. For more information, wire or write G. G. Fassnacht, 1330 W. Michigan St., Indianapolis, Ind.

Texas Water and Sewage Short School will be held March 9 to 13 at Texas A & M College, College Station, Texas. This is one of the really fine technical meetings held anywhere; and, in addition, the Texas weather and that "Little Shamrock" on the campus where visitors are housed, are attractions of a powerful nature. The Texas Department of Health, Austin, will help you get fixed up if you yield to that last-minute temptation.

JOBS FOR ENGINEERS

New York District, Corps of Engineers, 80 Lafayette St., N. Y., needs civil engineers.

San Diego, Calif., Civil Service Commission, desires applications for a training officer, $397 to $483. Write E. G. Stepanek.

Small Pay; Much Cold

Professional engineers, aides, surveymen and construction superintendents are wanted for work in Alaska. Salaries range from $3410 to $5940. More dope from District Engineer, Corps of Engineers, Bridge St., Buffalo 7, N. Y.

DIETZ NIGHT WATCH LANTERN

The NIGHT WATCH is strongly made, finished in Contractors' Yellow; Ruby Fresnel Globe with Peep-hole. Also accommodates Dietz Little Wizard and Little Giant Globes. Burns a generous 100 hours. 8" high, 6¾" diameter at non-tip base.

Write for circular.

STRAIGHT-LINE, PENCIL BEAM IS VISIBLE FROM ALL ANGLES, NEARBY OR AT REALLY GREAT DISTANCES.

Its exclusive fresnel globe is moulded with optically perfect prisms, designed to concentrate the light rays into a parallel, vertical beam of greatest possible intensity assuring a safety and warning light of greatest visibility. The NIGHT WATCH is the best burning lantern of its kind.

Exclusive trip-lock releases chimney for easy lighting, etc. Self-locking.

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MORE IRON AND STEEL SCRAP . . . OF ALL KINDS!

Steel mills and foundries need more scrap.

Not just "production" scrap from metal-fabricating plants . . . but also all sorts of *idle* iron and steel—from all types of plants.

Search *your* plant for this idle metal . . . work with your local scrap dealer to increase supplies of badly-needed iron and steel scrap.

What to look for . . .

obsolete machines, tools and equipment, no-longer-used jigs and fixtures, worn-out or broken chains, wheels, pulleys, gears, pipe, tanks, drums and abandoned metal structures. Non-ferrous is needed, too!

the search for PURE WATER

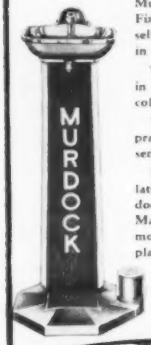
Fresh water in large silver flagons accompanied Persia's Cyrus the Great when he made war on his enemies. Drawn by mule cart, the water was boiled to make it "keep".

For excellence in MODERN water treatment equipment — gravity and pressure filters — recirculation apparatus . . .

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MFG. CO.
640 Columbia Ave.
Darby, Pa.

THE EVIDENCE PILES UP



During their long life Murdock Water Service Fixtures pay for themselves over and over again in the water they save.

They operate every day in the year no matter how cold it gets.

They give YEARS of practically trouble-free service.

Recommend the installation of additional Murdock Drinking Fountains. Make water available to more persons in more places.

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OUTDOOR DRINKING FOUNDTAINS
HYDRANTS
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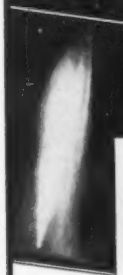
What does the Price Tag Say?



$500000 the COST OF BLIND DIGGING

Yes, for mere pennies a day you can have the satisfaction and security of knowing exactly where NOT-to-dig, — where pipes and cables are buried. Why take those unnecessary chances when the economical Detectron "505" gives you pin-point accuracy plus greater depth. There's nothing like a "505" Pipe Detector!

7¢ per day for "505" SECURITY Insurance against Costly Preventable Accidents

Write for Catalog No. 55

THE Detectron CO.
5631 Cahuenga
NORTH HOLLYWOOD, CALIF.

Worth Telling

by Arthur K. Akers

★ **Among FAIRBANKS,** Morse & Company promotions, J. A. CUNEO advances from manager of the Chicago branch to general sales manager.

★ **"DAVE" PURDIE,** employed on a "temporary" basis back in 1911 by BUILDERS IRON FOUNDRY, is shown here receiving his award for

40 years of service, latterly as New York manager for BUILDERS-PROVIDENCE, INC., from President Henry Chafee. Another 40 years, and we look for Dave to have a permanent job.

★ **GENERAL ELECTRIC,** at Electronics Park, Syracuse, N. Y., tells us that their 16mm. Civil Defense movie, "A Voice Shall be Heard," is available now through all G-E film libraries or the above Syracuse office.

★ **THE DORR COMPANY** advances these: J. D. Hitch to executive vice-

Mr. Hitch

Mr. Ford

president, T. B. Ford to vice-president in charge of sales.

★ **PIPE LININGS, INC.,** Los Angeles, subsidiary of AMERICAN PIPE AND CONSTRUCTION COMPANY, now handles relining of metal pipe lines in the western states, using the CENTRILINE process for pipe 16 to 144", the TATE process for 4 to 16" sizes.

★ **A. C. (ANDY) CARTWRIGHT** is new general sales manager for SEAMAN MOTORS INC., Milwaukee, makers of the well-known Seaman Mixer.

★ **DE LAVAL STEAM TURBINE** news includes: formation of a subsidiary, The DE LAVAL TURBINE PACIFIC COMPANY of San Francisco, with J. P. STEWART, president; and C. F. REEVES, vice-president and general manager. Also appointment of J. H. METZGAR as sales manager of Standard Products Division, Trenton, N. J.

★ **ARTHUR F. DRIES,** formerly with SERVICE SUPPLY CORPORATION, Philadelphia, is the new manager of sales promotion and advertising for all five GAR WOOD INDUSTRIES divisions.

Mr. Dingee

★ **JOHN H. DINGEE,** formerly advertising and sales promotion manager, HENRY DISSTON & SONS, INC., Philadelphia, is now manager of the power tool division, including chain saws.

★ **W. S. ZEIGLER,** manager of CATERPILLAR TRACTOR'S eastern sales division, will also take over J. W. MOHLER'S duties as assistant director of sales while Mohler is deputy director of Construction Machinery Division of NPA.

★ **CONTRACTORS PUMP BUREAU** has elected R. D. HOUGHTON, president of the RICE PUMP AND MACHINERY COMPANY, Grafton, Wis., as chairman of CPB's board of directors.

★ **DAVEY COMPRESSOR COMPANY,** Kent, Ohio, announces appointment of FREDERICK C. KIESER as export manager, in charge of their export activities, world-wide.

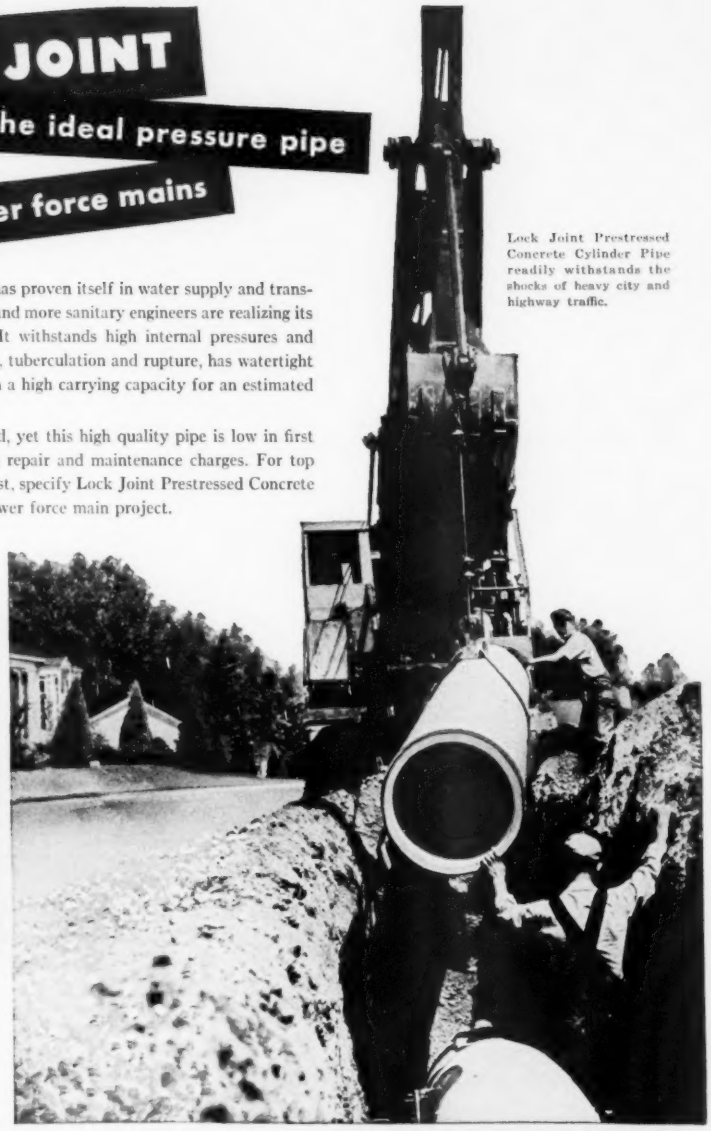
★ **LAST LAUGH:** A biology professor was unwrapping a parcel before his class, explaining that this was a fine specimen of a dissected frog. Upon exposing two sandwiches, a hard boiled egg, and a banana he was aghast. "But surely," he stammered, "I ate my l-lunch."

LOCK JOINT

the ideal pressure pipe for sewer force mains

Through the years Lock Joint has proven itself in water supply and transmission mains—and now more and more sanitary engineers are realizing its value for sewer force mains. It withstands high internal pressures and external loads, resists corrosion, tuberculation and rupture, has watertight flexible joints and will maintain a high carrying capacity for an estimated life of over 100 years.

Its performance is unexcelled, yet this high quality pipe is low in first cost and is virtually free from repair and maintenance charges. For top performance at rock bottom cost, specify Lock Joint Prestressed Concrete Cylinder Pipe for your next sewer force main project.



Lock Joint Prestressed Concrete Cylinder Pipe readily withstands the shocks of heavy city and highway traffic.

Its ability to withstand heavy backloads frequently makes it possible to lay Lock Joint Prestressed Concrete Cylinder Pipe in deep cuts without special bedding. The speed with which it may be laid and the fact that it can be immediately backfilled usually makes it unnecessary to sheet the trench.

SCOPE OF SERVICES—*Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Distribution Mains in a wide range of diameters as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.*

LOCK JOINT PIPE COMPANY

Est. 1905

P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

BRANCH OFFICES: Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. Kansas City, Mo. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. Wichita, Kan. • Kenilworth, N. J. • Hartford, Conn. • Tucumcari, N. Mex. Oklahoma City, Okla. • Tulsa, Okla. • Beloit, Wis. • Hato Rey, P. R.

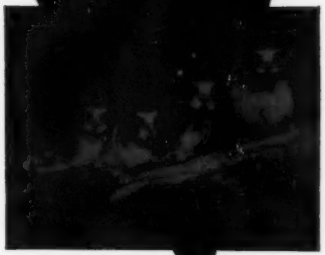
the part you don't see is important...

IN W&T CHLORINATORS, TOO!

When you look at a single W&T Chlorinator you can't *see* the basic research, the complete line of equipment, and the service that are behind it.

For instance, the engineer, the plant operator and the taxpayer all benefit from W&T's complete line of equipment. In the selection of equipment for a water supply — large or small — the engineer can always find a W&T Chlorinator to fit the requirements. The plant operator knows that this complete line can provide a W&T Chlorinator designed to help him provide safe water with his particular plant layout. The taxpayer is assured that money spent for W&T Equipment fitted to the present as well as the future needs of his community will provide long range economy.

These advantages of W&T's wide selection of equipment are probably one reason so many people use W&T Chlorinators.



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CHLORINE AND CHEMICAL CONTROL EQUIPMENT
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